

U.S. Coast Guard Research and Development Center
1082 Shennecossett Road, Groton, CT 06340-6096

Report No. CG-D-17-00

A METHOD FOR DEVELOPING MARINER ASSESSMENTS



FINAL REPORT
July 2000



This document is available to the U.S. public through the
National Technical Information Service, Springfield, VA 22161

Prepared for:

U.S. Department of Transportation
United States Coast Guard
National Maritime Center
Arlington, VA 22203-1804

DTIC QUALITY INSPECTED 4

20001124 104

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

This report does not constitute a standard, specification, or regulation.



Marc B. Mandler, Ph.D.
Technical Director
United States Coast Guard
Research & Development Center
1082 Shennecossett Road
Groton, CT 06340-6096

Technical Report Documentation Page

1. Report No. CG-D-17-00	2. Government Accession Number	3. Recipient's Catalog No.	
4. Title and Subtitle A METHOD FOR DEVELOPING MARINER ASSESSMENTS		5. Report Date July 2000	
7. Author(s) Marvin McCallum, Alice Forsythe, Alice Barnes, Myriam Smith, Jennifer Macaulay, George Sandberg, Joseph Murphy, and Paul Jackson		6. Performing Organization Code Project Number: 3302.3.2	
9. Performing Organization Name and Address Battelle Seattle Research Center 4500 Sand Point Way NE Seattle, WA 98105-0395		10. Work Unit No. (TRAIS)	
U.S. Coast Guard Research and Development Center 1082 Shennecossett Road Groton, CT 06340-6096		11. Contract or Grant No. Contract DTG39-94-D-E00777, Delivery Order No. 97-E-E00357/25	
12. Sponsoring Organization Name and Address U.S. Department of Transportation United States Coast Guard National Maritime Center (NMC) Arlington, VA 22203-1804		13. Type of Report & Period Covered Final	
15. Supplementary Notes The R&D Center's point of contact is Dr. Anita Rothblum, 860-441-2847, arothblum@rdc.uscg.mil .		14. Sponsoring Agency Code Director (NMC-4B) United States Coast Guard National Maritime Center Arlington, VA 22203-1804	
16. Abstract (MAXIMUM 200 WORDS) This report presents a systematic method for developing reliable and valid performance-based assessments (PBA) of mariner proficiencies. The method is compliant with: the requirements of the International Maritime Organization's (IMO) <i>Seafarers' Training, Certification and Watchkeeping Code (STCW Code)</i> , as amended in 1995; with all relevant U.S. Coast Guard Navigation and Vessel Inspection Circulars (NVIC); with Instructional Systems Development (ISD); and with the best practices of the maritime industry. The method guides the developer through five steps: 1) specify assessment objectives, 2) determine assessment methods, 3) specify assessment conditions, 4) develop proficiency criteria, and 5) prepare the assessment materials. The report provides materials for a developer's workshop, a stand-alone assessment development manual, and four sample assessments that have been developed by project participants. Guiding materials for the actual conduct of such assessments are provided in a separate report (R&DC-204).			
17. Key Words Performance (human) Performance tests Proficiency Ship personnel	Skills Trainees Training management Transfer of training	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161.	
19. Security Class (This Report) UNCLASSIFIED	20. Security Class (This Page) UNCLASSIFIED	21. No of Pages 245	22. Price

Form DOT F 1700.7 (8/72) Reproduction of form and completed page is authorized.

ACKNOWLEDGMENTS

This report documents some of the recent work of an ongoing research and development project that has been conducted by the United States Coast Guard (USCG) Research and Development Center for the USCG National Maritime Center over the past several years. The authors of this report have had the opportunity and pleasure to gain an understanding of the theoretical and practical issues involved in mariner assessment while working with many knowledgeable experts. We would especially like to thank our sponsors; representatives from USCG Headquarters and Maritime Administration (MARAD); academy representatives; industry representatives; and colleagues who have supported this effort.

Mr. Perry Stutman of the USCG National Maritime Center has provided continual support and guidance in the conduct of this project. We have also received support and guidance during the course of this work from other members of the National Maritime Center, including Captain William Bennett, Mr. John Bobb, Mr. David Field, and Mr. Albert Kirchner.

Mr. Christopher Young of USCG Headquarters and Mr. Christopher Krusa of MARAD have provided critical comments, suggestions, and support at several points during this project.

Early collaboration with United States Merchant Marine Academy faculty members significantly influenced the later orientation of this effort. Participants of that early work included Captains Richard Stewart, Douglas Hard, and Robert Meurn. More recently, Ms. Emily Sporn of Massachusetts Maritime Academy and Mr. Robert Hammaker of California Maritime Academy have supported their colleagues in developing sample assessment procedures.

We have had several opportunities to present and discuss issues regarding mariner assessment with representatives from industry. Special thanks go to Mr. Charles Accardi of ARCO, Captain B. J. Acme of Seattle Maritime Academy, Captain Richard Beadon of Seaman's Church Institute, Captains Thomas Blanchard and Nils Knutstad of SeaRiver Maritime, Inc., Mr. John Crawford of Crawford Nautical School, Mr. William Eglinton of the Harry Lundberg School, Mr. Michael Godbey of Crowley Marine, Ms. Leslie Hughes of the North Pacific Fishing Vessels Owners Association, Captain Lee Kincaid of the MEBA Engineering School, Captain Roger Mercer of the Alaska Vocational Technical School, Captain Kelly Mitchell of Alaska Marine Highways, Captain Jack Newbold of I.B.U. of the Pacific, Captain Charles Pillsbury of MITAGS, Admiral David Ramsey of Marine Safety International, Mr. Albert Stiles from the Center for Advanced Maritime Officers Training, and Mr. Gregory Szczeruk of Houston Marine Training Services.

Finally, we would like to thank our colleagues who reviewed this report, as well as earlier related efforts, including Ms. Susan Czarny, Ms. Mireille Raby, and Dr. Thomas Sanquist from Battelle, and Dr. Anita Rothblum, Ms. Elizabeth Weaver, Ms. Irene Gonin, and Dr. Brooke Schaab from the United States Coast Guard Research and Development Center.

EXECUTIVE SUMMARY

Introduction to the research and development project

The assessment of mariner proficiencies by practical demonstration is mandated by the International Maritime Organization (IMO) in its 1995 amendments to the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention)* and the accompanying *Seafarer's Training, Certification and Watchkeeping Code (STCW Code)*. This requirement is a substantial departure from earlier practice, and methods for developing, conducting, and documenting such assessments must be established. The United States Coast Guard's (USCG) National Maritime Center (NMC) is sponsoring a research project through the USCG Research and Development Center (R&DC) to examine the implications of the mandate and to ensure that the best practices are available to the industry. One major objective of the project is to provide a systematic, step-by-step process for developing reliable and valid assessments and investigate its feasibility for implementation.

Project efforts reported here

The performance-based assessment (PBA) method, as described in this report, is compliant with the requirements of the STCW Code, relevant USCG Navigation and Vessel Inspection Circulars (NVICs), Instructional Systems Development (ISD), and the best practices of industry. An objective of this phase of the project was to refine the PBA method and to prepare materials to assist the industry in applying it. The approach to achieving this objective was to introduce the method to a varied sample of industry representatives through workshops and to invite some of them to participate in trial applications of the method. As a result of these efforts, the materials provided in this report have benefited from multiple reviews, multiple trial applications, and substantial comment. Materials to guide the *development* of assessment procedures that are provided here include a workshop (Chapter 2), a manual (Chapter 3), and four sample assessments (Appendices A through D). The industry representatives who participated in the project and came to understand the method were quite positive about the value of the general method in enhancing the rigor of assessment procedures. They are applying it in their own settings – sometimes with their own adaptations to their particular circumstances. Comparable guidance and materials to support the *conduct* of assessments, are provided in a separate report (R&DC-204).

Recommendations

For the most effective implementation of the project's findings and products, the following actions are recommended to the USCG and the maritime industry.

- The USCG should encourage the maritime industry in the use of the PBA method, as described in the project reports and materials. As a first step, the materials should be made widely available, on the USCG STCW website (<http://www.uscg.mil/stcw>) and through the National Technical Information Service (NTIS). When the industry becomes more familiar with the PBA method, it can serve as the basis for a new NVIC. The

USCG should submit the PBA supporting materials to the IMO subcommittee on Standards for Training and Watchkeeping.

- The USCG should encourage further familiarity with the PBA approach by USCG staff, as a tool for discussions of assessment with the industry and for the review of procedures submitted for approval.
- The USCG should encourage the review and use of the PBA method and materials by those groups that are dealing with the important technical issues of assessment, such as the Maritime Academy Simulator Committee (MASC), the Merchant Marine Personnel Advisory Committee (MERPAC), and academy committees appointed by the Maritime Administration (MARAD) to address STCW issues. The materials can provide a common approach and a common basis for discussion.
- Those in the industry who are responsible for training and assessment of mariner proficiency in academies, training schools, and shipping companies should make use of the PBA method and the materials presented here as a guide for their own development of assessment procedures. The materials are especially appropriate for inclusion in train-the-trainer courses.

TABLE OF CONTENTS

Executive Summary	v
List of Acronyms And Abbreviations	viii
Chapter 1 - Overview	1-1
Chapter 2 - A Workshop for Assessment Developers.....	2-1
Chapter 3 - A Manual for Assessment Developers	3-1
Appendix A: Mariner Assessment Procedures for the Performance of Lookout Duties	A-1
Appendix B: Mariner Assessment Procedures for the Performance of Helmsman Duties.....	B-1
Appendix C: Mariner Assessment Procedures for Preparing the Main Engine for Operation ..	C-1
Appendix D: Mariner Assessment Procedures For Locating Common Faults And Preventing Damage to Generators	D-1

LIST OF ACRONYMS AND ABBREVIATIONS

ARPA	Automatic Radar Plotting Aid
CFR	Code of Federal Regulations
IMO	International Maritime Organization
ISD	Instructional Systems Development
MARAD	Maritime Administration
MASC	Maritime Academy Simulator Committee
MERPAC	Merchant Marine Personnel Advisory Committee
NMC	National Maritime Center
NTIS	National Technical Information Service
NVIC	Navigation and Vessel Inspection Circular
PBA	Performance-based assessment
R&DC	Research and Development Center
STCW Code	Seafarers' Training, Certification and Watchkeeping Code
STCW Convention	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
USCG	United States Coast Guard

A METHOD FOR DEVELOPING MARINER ASSESSMENTS

Chapter 1

OVERVIEW

This chapter provides a brief overview of a systematic method for developing reliable and valid performance-based assessments. It also describes other materials included in this report to guide the development of assessment procedures: a workshop (Chapter 2), a developer's manual (Chapter 3), and four sample assessments (Appendices A through D).

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

CHAPTER 1 - OVERVIEW

Introduction	1-3
Objectives and Approach	1-3
Report Organization	1-4
Assessment Development Method Overview	1-5
Practical Aids For Developing Mariner Assessments	1-8
Conclusions And Recommendations	1-12
References	1-14

LIST OF ILLUSTRATIONS

Figure 1. Five-step method for developing mariner performance-based assessments	1-6
---	-----

LIST OF TABLES

Table 1. Summary of workshop module lecture slides and practical exercises	1-8
--	-----

INTRODUCTION

The assessment of mariner proficiencies by practical demonstration is mandated for numerous areas of competence by the International Maritime Organization (IMO) in its 1995 amendments to the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention)* (1996A) and the accompanying *Seafarer's Training, Certification and Watchkeeping Code (STCW Code)*. In response to this requirement, the United States Coast Guard (USCG) has provided guidance in the assessment of mariner skills and knowledge that calls for a *practical demonstration* of mariner proficiency (46 CFR 10.103; 46 CFR 12.01-6; USCG, 1997A; USCG 1997B; USCG 1997C). Here, *practical demonstration* refers to mariner performance of an activity that is determined to meet a specified standard of proficiency by an assessor.

This requirement for the practical demonstration of proficiency is a substantial departure from earlier assessment practice in the maritime community. In order to meet this new requirement, methods for developing, conducting, and documenting such assessments must be established. The USCG National Maritime Center (NMC) is sponsoring a research project through the USCG Research and Development Center (R&DC) to examine the implications of these requirements and to ensure that the best practices are available to the maritime industry. Past project efforts have resulted in the specification of a *performance-based assessment* (PBA) method for developing mariner assessments. This method was initially refined during a trial application to Automatic Radar Plotting Aid (ARPA) operator assessment (McCallum, Forsythe, Smith, Nunnenkamp, & Sandberg, 2000). The trial application required extensive guidance and technical support by assessment development experts. Following that application, it was concluded that broader adoption of the method by the maritime community would require further refinement of the PBA method, as well as development of aids to support application of the method. Specific aids selected for development included a workshop on assessment development, a practical guide for assessment development, and a set of sample assessment procedures.

Objectives and Approach

The general objective of the present effort is to further refine the PBA method and to develop supporting materials that will aid in the broader application and implementation of the PBA method within the maritime community. The more specific objective of this effort is to provide practical support to the assessment developers and assessors who must respond to these requirements within the United States. Three related products were identified for development:

- *A Workshop for Assessment Developers* to introduce the PBA method to individuals responsible for developing assessment procedures.
- *A Manual for Assessment Developers* to provide a reference and aid during assessment procedure development.
- A set of sample assessment procedures to serve as content and format guides for developing assessments in accordance with the PBA method.

Refinement of the PBA method and preparation of the supporting materials were complementary and concurrent activities. First, the workshop was drafted and presented to government and industry representatives of the maritime community in order to refine both the general PBA method and the workshop materials. Next, faculty members from two maritime academies developed four sample assessment procedures. During assessment development, the faculty participants provided suggestions regarding the guidance required for preparing assessment procedures, assessment procedure content, and assessment procedure format. Then, a draft of the assessment development manual was prepared and reviewed by representatives of the maritime community. Finally, based on the comments received and lessons learned, all of the PBA materials were revised to incorporate consistent methods, procedures, and language.

Report Organization

Chapter 1 of this report is intended to serve as a brief introduction, and is divided into three sections. First, a brief overview of the PBA method, as it applies to assessment procedure development, is provided. Then, the products of this project – *A Workshop for Assessment Developers*, *A Manual for Assessment Developers*, and the four sample assessment procedures – are briefly described. The final section of this chapter presents conclusions regarding the technical value of these products and issues concerning their implementation, as well as recommendations regarding future actions that should be taken to foster broad implementation of the PBA method.

Following this chapter are the products of this project. These products are stand-alone resources that can be used by the maritime community to aid in the implementation of the PBA method. Chapter 2 provides the *A Workshop for Assessment Developers* materials. Chapter 3 *A Manual for Assessment Developers* provides a step-by-step method for developing performance-based assessments, and contains a glossary of assessment-related terms. Appendices A, B, C, and D provide the sample assessments.

ASSESSMENT DEVELOPMENT METHOD OVERVIEW

A review of the *STCW Code*, other IMO documents, USCG guidance in Navigation and Vessel Inspection Circulars (NVICs), the methods of Instructional Systems Development (ISD), and the best practices of the maritime industry was performed. From these sources, a step-by-step *performance-based assessment* (PBA) method for developing mariner assessments was defined. In its broader form, the PBA method also addresses the *conduct* of assessments. However, the current report is limited to a consideration of assessment *development*. The conduct of assessments will be the topic of a future report.

Three basic assumptions underlie the PBA method. The first assumption is that an *expert assessor* will conduct assessments by observing a *practical demonstration* by a mariner. Generally, an *expert assessor* is a mariner qualified in the proficiencies being assessed and trained in the procedures of assessment. In the United States, an expert assessor will be qualified as a *designated examiner*, as defined in NVIC 6-97 (USCG, 1997B).

The second assumption is that the objective of conducting assessments is to obtain *valid* and *reliable* determinations of mariner proficiency. A *valid* assessment accurately determines mariners' proficiency in meeting the skill, knowledge, and performance requirements of a job. A *reliable* assessment results in consistent proficiency determinations between assessment applications.

The third basic assumption is that assessment validity and reliability require the prior development of assessment procedures, which include specification of mariner *performance measures*, *performance standards*, and *proficiency criteria*. A *performance measure* is the procedure used for observing and recording a mariner action. A *performance standard* is the level of a performance measure that must be achieved to be acceptable for assessment purposes. *Proficiency criteria* are the scoring procedures applied in determining the proficiency of a candidate on the basis of performance measures and performance standards.

Figure 1 depicts the five-step PBA method for developing assessments of mariner proficiency. The important first step, on which the method depends, is to *specify assessment objectives*. Using such sources as the *STCW Code*, established procedures, and expert opinion, the performance elements to be assessed are listed and defined. Careful analysis of objectives provides a basis to *determine assessment methods*, *specify assessment conditions*, and *develop proficiency criteria*. Finally, with the analytical work completed, the assessment developer can *prepare assessment materials*. The assessment materials are a relatively self-contained set of procedures and instructions that can be circulated for expert review and, ultimately, provided to the assessor who will conduct the assessment. This approach is compatible with that described in IMO circular 853 (IMO, 1998).

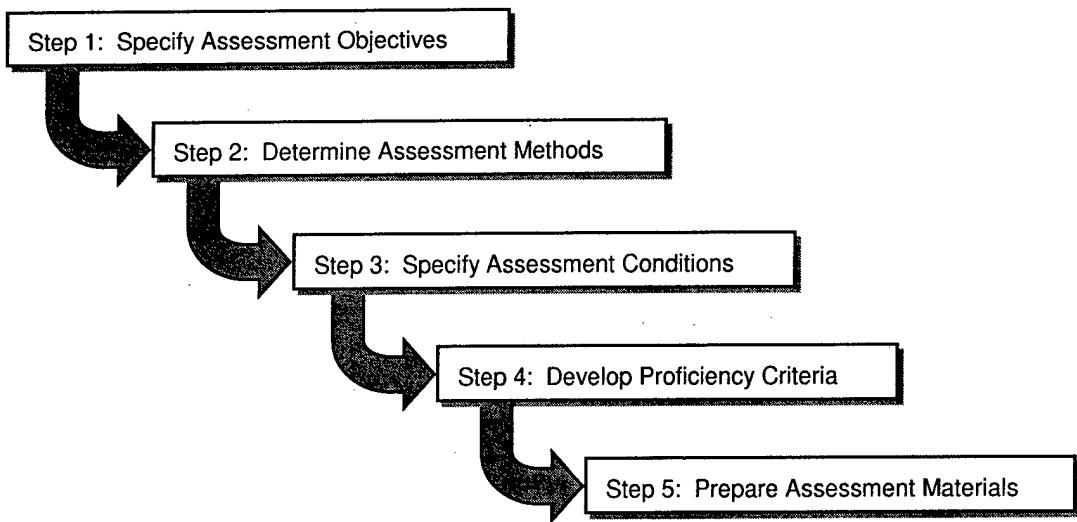


Figure 1. Five-step method for developing mariner performance-based assessments.

The background and basis for the PBA method, as it applies to assessment development, is described in greater detail in a more lengthy technical report (McCallum, Forsythe, Smith, Nunnenkamp, & Sandberg, 2000). An extension of the method to evaluating the capability of simulators to support mariner assessment is documented in a separate technical report (Raby, Forsythe, McCallum, & Smith, 2000). Guidance in the practical application of the PBA method is discussed in the next section, which introduces *A Workshop for Assessment Developers* (Chapter 2), *A Manual for Assessment Developers* (Chapter 3), and the sample assessment procedures (Appendices A, B, C, and D).

Early in the research project, it became apparent that *developing* and *conducting* assessments were separate functions, likely to be performed by different individuals with different backgrounds and sometimes even by different organizations. The efforts described in this report focused on developing assessments. These materials were prepared with the assumption that the resulting assessment materials would be provided to an assessor who would prepare for and conduct the actual assessment.

More recent project efforts focus on providing guidance and practical aids to the assessor. Currently, training officers from a major commercial shipping company are adapting the assessment procedures presented in this report to their own operations and equipment. These training officers will assist ship officers in assessing candidate proficiency onboard their vessels. One implementation issue of immediate concern to them has been the appropriate level of detail in the specification of assessment objectives, measures, and standards. Another issue concerns the consistency between the company's established operating procedures and the performance

standards required by the assessments. Findings relevant to these and other implementation issues will be provided in a future report (McCallum, Barnes, Forsythe, and Smith, 2000), along with guidance and practical aids for conducting assessments.

PRACTICAL AIDS FOR DEVELOPING MARINER ASSESSMENTS

This section of the report introduces the three products resulting from this phase of the project, which have been prepared to aid the maritime community in the practical application of the PBA method. Each product is briefly described, along with a discussion of the process of its development, any pertinent findings during development of the product, and issues concerning implementation or further refinement of the product.

A Workshop for Developing Mariner Assessments

Following initial definition of the PBA method, it was recognized that a training workshop could serve as a useful means of introducing this method to people in the maritime community who would be responsible for some aspect of mariner assessment. A workshop was drafted and presented to individuals from the government and private sectors of the maritime industry in two sessions in March and April of 1998. *A Workshop for Assessment Developers* was initially developed as a three-day introduction to developing and conducting assessments. However, it was later recognized that the two functions of developing and conducting assessments could best be addressed in separate workshops focusing on the assessment developer and assessor roles. This report provides the workshop that focuses on assessment development (See Chapter 2). A separate report (R&DC-204) provides guidance and practical aids for the conduct of assessments.

In its current format, the workshop consists of eight modules. Each module consists of lecture slides, and five of the modules have practical exercises, as summarized in Table 1. The workshop is estimated to require approximately two days. Chapter 2 provides the course curriculum outline, the set of slides used to support the lectures and exercises, and the exercise materials.

Table 1. Summary of workshop module lecture slides and practical exercises.

Workshop Module	Lecture Slides	Practical Exercise
1	Introduction to Assessment Development Process	None
2	Validity and Reliability	1. Understanding Validity and Reliability
3	Step 1: Specify Assessment Objectives	2. Specifying Assessment Objectives
4	Step 2: Determine Assessment Methods	3. Determining Assessment Methods
5	Step 3: Specify Assessment Conditions	4. Specifying Assessment Conditions
6	Step 4: Develop Performance Criteria	5. Developing Performance Measures 6. Developing Performance Standards
7	Step 5: Prepare Assessment Materials	None
8	Summary/Overview	None

Participants in the 1998 sessions generally viewed the workshop as a useful means of introducing a systematic method for developing mariner assessments. They also identified a number of issues that they thought would affect the successful implementation of the workshop. First, it was seen as important that the full range of those involved in assessment development within the maritime community have an opportunity to participate, including government personnel who regulate mariner assessment, faculty members of maritime academies and schools, and shipping company training staff. A second critical issue concerned the qualifications of the workshop leaders, who should have a broad understanding of instructional system development, general knowledge of mariner assessment policy, and familiarity with mariner proficiency requirements. Finally, many workshop participants viewed the practical exercises as central to the learning experience. They stressed the importance of allowing adequate time to complete each exercise and to have the workshop leader conduct a critical review of the exercise results.

A Manual on Developing Mariner Assessments

The initial set of workshop materials included a set of job aids that were intended to help assessment developers in applying the PBA method. Early reviewers of these job aids noted their strong preference for an integrated manual that could be used as a reference and aid throughout the assessment development process. In response, *A Manual for Assessment Developers* was prepared (See Chapter 3). Early drafts of this manual were reviewed by several participants in the current project and refined in response to their comments. The current version of the manual is intended for anyone in the maritime industry who is responsible for the development of assessments that will rely upon practical demonstration and comply with IMO *STCW Code* requirements.

The manual provides a step-by-step method for assessment development. It is organized around the five PBA assessment development steps (see Figure 1), with each step further divided into additional sub-steps. Detailed instructions for completing each sub-step are provided. The manual also includes several decision aids and heuristics for assessment developers. Throughout the manual, an extended example is provided, based upon the *lookout duties* sample assessment, showing how to apply the steps of the assessment development process. In addition, the complete sample assessment for lookout duties is provided as an attachment to the manual. A copy of the manual is provided as Chapter 3, *A Manual for Assessment Developers*.

Reviewers consistently acknowledged the technical and practical value of the manual as a reference and aid in assessment development. Many reviewers also expressed concern about the complexity of the assessment development process. This concern typically has focused more on issues concerning the level of effort required to develop the large set of assessment procedures specified by the *STCW Code*, rather than the technical complexity of the process itself. That is, all reviewers have noted that, after investing some time in studying the manual, they understand the process for developing assessment procedures and are comfortable applying it. However, these individuals also recognize that a significant level of effort will be required to develop such procedures for the range of proficiencies identified in the *STCW Code*.

In addition, reviewers frequently expressed concern about the consistency of terminology among IMO doctrine, USCG NVICs, the ISD literature, and the manual. IMO terminology has been

used as much as possible. One result of this approach has involved the use of the term “assessor,” which is used in IMO documents, rather than the term “designated examiner,” which is the term used in the USCG NVIC 6-97 (USCG, 1997B).

Sample Assessment Procedures

A key activity in the present PBA research effort involved the development of a set of sample assessment procedures. Faculty members from Massachusetts Maritime Academy prepared two assessments for navigation watch proficiencies – *Performance of Lookout Duties* and *Performance of Helmsman Duties*. Faculty members from California Maritime Academy prepared two assessments for engineering watch proficiencies – *Preparing the Main Engine for Operation* and *Locating Common Faults and Preventing Damage to Generators*.

The academy participants prepared the sample assessments using the draft workshop materials with only limited review and guidance from the project’s assessment development experts. As part of the assessment development process, the participating faculty members conducted trial applications of draft assessment procedures with academy cadets playing the role of candidates. As a result of their work in developing the sample assessments, the faculty participants provided critical comments regarding the technical adequacy of the PBA method, specific areas where more complete guidance was required, and potential standards for assessment procedure content and format.

During the course of developing the four assessment samples, several standard approaches toward assessment procedure content and format evolved. Specific areas where standard approaches were developed included assessment control sheets and worksheets, examiner instructions, candidate instructions, and assessment documentation. These standard approaches are reflected in both *A Manual for Assessment Developers* and the sample assessments procedures. Appendices A through D provide the four sample assessments.

In developing the assessments, a number of issues were raised that have yet to be fully reconciled. First, there is the issue regarding the appropriate level of detail of performance objectives, measures, and standards. The current set of samples has a consistent level of detail, in which all specific actions required of a candidate are defined. An alternative approach would be to provide more general guidance with less detailed definitions of performance measures and standards. In this case, existing operating procedures would be assumed to provide the basis for defining measures and standards. The present authors are concerned that a less detailed approach would be likely to reduce assessment validity and reliability. Typically, existing operating procedures do not provide adequately comprehensive and accurate performance steps and standards to support valid and reliable assessment. However, a reduced level of detail is viewed by some as necessary in order to deal with the large number of assessments that must be developed. Further information regarding this issue will be obtained during the trial application of the sample assessments currently underway at the participating commercial shipping company.

A second issue concerns subject matter expert review of assessment procedures. In an industry with a high degree of individualism, it is not surprising that one of the areas where assessment developers confronted difficulties was in obtaining consensus agreement among other operational experts regarding the suitability of the developed procedures. In developing the

sample assessments, the participating faculty had difficulty in convening a group of experts and reaching consensus on the proficiency measures, standards, and scoring procedures. This issue, as well as those identified earlier in this section, is reviewed and discussed in the following section of this report.

CONCLUSIONS AND RECOMMENDATIONS

The major objectives of this phase of the project were to refine the PBA method and to prepare materials to assist the industry in applying it. The approach to achieving these objectives involved introducing the method to a varied sample of industry representatives through the workshops and inviting some of them to participate in trial applications of the method. This approach provided the opportunity to refine both the general method and the materials. The materials provided here – workshop, manual, and sample assessment procedures – have benefited from multiple reviews, multiple trial applications, and substantial comment.

Conclusions

The PBA method, as described in this report, is compliant with the requirements of the *STCW Code*, USCG NVICs, ISD, and the best available industry practices. The industry representatives who participated in the project and came to understand the method were quite positive about the value of the general method in enhancing the rigor of assessment procedures. They are currently applying it in their own situations – sometimes with their own adaptations. If the PBA method is to be applied more broadly in the industry, these materials must be more widely available.

As the trial assessments were developed and circulated for review, several difficult technical issues were identified that have not been resolved. One issue is uncertainty about the level of detail appropriate in the development of an assessment procedure. How much detail is necessary in describing the assessment objectives and criteria to assure reliability and validity? How much should be left to the judgment of the assessor? There is certainly no one answer to the question of how much detail is needed. Major considerations will include the particular proficiency in question and the circumstances under which the assessment will be conducted. The trial applications being conducted with the commercial shipping company will provide some insight into this issue in at least one real context. Participants from the shipping company will provide suggestions based on their experience with the assessments regarding the level of detail appropriate in the assessment materials and the level of detail required in assessment instructions, measures, standards, and scoring procedures.

A second issue is the difficulty in convening expert panels and obtaining consensus about the appropriate assessment objectives, measures, and standards. Some of the difficulty in holding and conducting such meetings stemmed from a lack of familiarity with the PBA method among those who were asked to serve as experts. It is expected that broader implementation of the PBA method would mitigate much of this problem. However, there is also a related issue of experts representing different organizations and operational settings. Different operational settings are often associated with legitimate differences in the performance requirements of mariners. In these cases, the differences must be either reconciled through changes in operations, or recognized and reflected in different assessment objectives, measures, and standards.

An additional issue concerns the level of effort required to prepare a full set of assessments that will be responsive to the full range of proficiencies identified in the *STCW Code*. It must be recognized that the broad sets of proficiencies defined in the *STCW Code* resulted from an extensive effort. Providing the detailed assessment procedures for all proficiencies is a much

more extensive effort. However, several factors could help reduce the overall level of effort and provide adequate time for the systematic development and implementation of procedures. First, many of the operating procedures and standards upon which these assessments will be based already exist. Shipping companies and individual vessels typically have standard operating policies and procedures for their crews, which can serve as the starting point in developing assessments. Second, in many cases, assessment procedures can be developed and shared within and between organizations. Schools and academies could share assessment procedures, as could similar ships. Differences in operating requirements that dictate differences in the assessment objectives, measures, and standards, will typically represent variations across similar assessments and much of the content and format of assessments could still be shared.

Early in the project's examination of PBA, it became apparent that *developing* and *conducting* assessments were separate functions, likely to be performed by separate individuals and even separate organizations. Further project efforts will examine the issues of conducting mariner assessments, including planning for the actual conduct of a procedure, the degree of detail appropriate for the assessment forms, and the amount of familiarization or training needed by the assessor. A separate report provides materials for use in conducting assessments.

Recommendations

For the most effective implementation of the project's findings and products, the following USCG and industry actions are recommended.

- The USCG should encourage the maritime industry in the use of the PBA method, as described in the project reports and materials. As a first step, the materials in this report should be made widely available, on the USCG STCW website (<http://www.uscg.mil/stcw>) and through the National Technical Information Service (NTIS). When the industry becomes more familiar with the PBA method, it can serve as the basis for a new NVIC. In addition, the USCG should submit the PBA supporting materials to the IMO subcommittee on Standards for Training and Watchkeeping.
- The USCG should encourage further familiarity with the PBA approach by USCG staff, as a tool for discussions of assessment with the industry and for the review of procedures submitted for approval.
- The USCG should encourage the review and use of the PBA method and materials by those groups who are dealing with the important technical issues of assessment, such as the Maritime Academy Simulator Committee (MASC), the Merchant Marine Personnel Advisory Committee (MERPAC), and academy committees appointed by the Maritime Administration (MARAD) to address STCW issues. The materials can provide a common approach and a common basis for discussion.
- Those in the industry who are responsible for training and assessment of mariner proficiency in academies, training schools, and shipping companies should make use of the PBA method and the materials presented here as a guide for their own development of assessment procedures. The materials are especially appropriate for inclusion in train-the-trainer courses.

REFERENCES

International Maritime Organization. (1996A). International convention on standards of training, certification and for seafarers, 1978, as amended in 1995 (STCW Convention). London: Author.

International Maritime Organization. (1996B). Seafarers' training, certification and watchkeeping code (STCW Code). London: Author.

International Maritime Organization. (1998). Guidance on shipboard assessments of proficiency (Marine Safety Committee Circular No. 853). London: Author.

McCallum, M. C., Barnes, A. E., Forsythe, A. M., & Smith, M. W. (2000). Conducting mariner assessments: A trial application of procedures, training and manuals. (Report No. R&DC 204). Groton, CT: U.S. Coast Guard Research and Development Center. In review.

McCallum, M. C., Forsythe, A. M., Smith, M. W., Nunnenkamp, J. M., & Sandberg, G. R., (2000). Developing performance-based assessments of mariner proficiency (Report No. R&DC 303). Groton, CT: U.S. Coast Guard Research and Development Center. In revision.

Raby, M., Forsythe, A. M., McCallum, M. C., & Smith, M. W. (2000). Evaluating simulators for assessment of mariner proficiency (Report No. R&DC 150). Groton, CT: U.S. Coast Guard Research and Development Center Technical Report. In revision.

United States Office of the Federal Register. (1995). 46 Code of Federal Regulation (CFR) Parts 10, 12, and 15.

United States Coast Guard. (1997A). Guidance on company roles and responsibilities under the 1995 Amendments to the International Convention on Standards of Training, Certification and Watchkeeping (STCW). Navigation and Vessel Inspection Circular No. 4-97 [Online]. Available: <http://uscg.mil/hq/g-m/nvic/4-97/n4-97.htm>

United States Coast Guard. (1997B). Guidance on qualified instructors and designated examiners. Navigation and Vessel Inspection Circular No.6-97 [Online]. Available: <http://www.uscg.mil/hq/g-m/nvic/6-97/n6-97/n7-97.htm>

United States Coast Guard. (1997C). Guidance on STCW quality standards systems (QSS) for merchant mariner courses or training programs. Navigation and Vessel Inspection Circular No.7-97 [Online]. Available: <http://www.uscg.mil/hq/g-m/nvic/7-97/n7-97.htm>

A METHOD FOR DEVELOPING MARINER ASSESSMENTS

Chapter 2

A WORKSHOP FOR ASSESSMENT DEVELOPERS

This chapter contains an outline, slides, and exercises for a two-day workshop on developing mariner assessments.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

ACKNOWLEDGMENTS

This workshop represents the current point in an ongoing research and development project conducted by the United States Coast Guard (USCG) Research and Development Center for the USCG National Maritime Center over several years. The following sponsors, academy representatives, and industry representatives, supported the development of this workshop.

Mr. Perry Stutman of the United States Coast Guard National Maritime Center has provided continual support and guidance in the conduct of this project. Other members of the National Maritime Center, including Captain William Bennett, Mr. John Bobb, Mr. David Field, and Mr. Albert Kirchner also provided support and guidance during the course of this work.

Participants of early work that significantly influenced the orientation of the current effort include Captains Richard Stewart, Douglas Hard, and Robert Meurn, all faculty members of the United States Merchant Marine Academy.

Several representatives from the maritime industry participated in early versions of this workshop and provided constructive comments. Special thanks go to Mr. Charles Accardi of ARCO, Captain Joseph Murphy of Massachusetts Maritime Academy, Mr. Robert Hammaker of California Maritime Academy, Captain B. J. Acme of Seattle Maritime Academy, Captain Richard Beadon of Seaman's Church Institute, Captains Thomas Blanchard and Nils Knutstad of SeaRiver Maritime; Mr. John Crawford of Crawford Nautical School; Mr. William Eglinton of the Harry Lundberg School; Mr. Michael Godbey of Crowley Marine; Ms. Leslie Hughes of the North Pacific Fishing Vessels Owners Association; Captain Lee Kincaid of the MEBA Engineering School; Captain Roger Mercer of the Alaska Vocational Technical School; Captain Kelly Mitchell of Alaska Marine Highways; Captain Jack Newbold of I.B.U. of the Pacific; Captain Charles Pillsbury of MITAGS; Admiral David Ramsey of Marine Safety International; Mr. Albert Stiles from the Center for Advanced Maritime Officers Training; and Mr. Gregory Szczurek of Houston Marine Training Services.

Finally, a special thanks goes to several colleagues who reviewed this workshop and earlier related efforts: Ms. Susan Czarny, Ms. Mireille Raby, and Dr. Thomas Sanquist from Battelle; and Dr. Anita Rothblum, Ms. Irene Gonin, and Dr. Brooke Schaab from the USCG Research and Development Center.

CHAPTER 2- A WORKSHOP FOR ASSESSMENT DEVELOPERS

Workshop Outline	2-4
Workshop Slides	2-6
Introduction to Assessment Development Process	2-6
Validity and Reliability of Mariner Assessment	2-9
Step 1: Specify Assessment Objectives	2-11
Step 2: Determine Assessment Methods	2-15
Step 3: Specify Assessment Conditions	2-18
Step 4: Develop Proficiency Criteria	2-20
Step 5: Prepare Assessment Materials	2-28
Summary	2-30
Workshop Exercises	2-31
Exercise 1: Understanding Validity and Reliability	2-31
Exercise 2: Specifying Assessment Objectives	2-37
Exercise 3: Determining Assessment Methods	2-49
Exercise 4: Specifying Assessment Conditions	2-55
Exercise 5: Developing Performance Measures	2-61
Exercise 6: Developing Performance Standards	2-69

Developing Mariner Assessments: Workshop Outline

Subject Area	Hours	
	Lectures	Exercise
1.0 Introduction to Assessment Development Process		
1.1 Workshop staff and participant introductions	.25	
1.2 Review of research project context, instructional theory, and recent guidance from various sources	.25	
1.3 Workshop scope, audience, objectives, and agenda	.25	
1.4 Assessment uses, successes, and examples	.15	
1.5 Overview of assessment development process	.10	
	1.00	
2.0 Validity and Reliability		
2.1 Definition of validity	.25	
2.2 Overview of issues relevant to validity	.10	
2.3 Definition of reliability	.25	
2.4 Overview of issues relevant to reliability	.10	
2.5 Discussion of validity and reliability of mariner assessments, including practical experience with reliability and validity (Exercise 1)	.10 1.00	.50 .50
3.0 Step 1: Specify Assessment Objectives		
3.1 Selection of proficiency to be assessed	.10	
3.2 Identification of regulatory requirements	.25	
3.3 Analysis of job requirements	.40	
3.4 Specification of assessment objectives	.25	
3.5 Examples of assessment objectives	.25	
3.6 Discussion of specifying assessment objectives, including practical experience with specifying assessment objectives (Exercise 2)	.25 1.50	.50 .50
4.0 Step 2: Determine Assessment Methods		
4.1 Overview of basic assessment methods	.25	
4.2 Pros and cons of basic assessment methods	.25	
4.3 Overview of steps and issues in determining assessment methods	.25	
4.4 Examples of assessment methods	.25	
4.5 Discussion of determining assessment methods, including practical experience with determining assessment methods (Exercise 3)	.25 1.25	.25 .25

5.0 Step 3: Specify Assessment Conditions		
5.1 Overview of steps involved and issues to consider	.25	
5.2 Conditions requiring specification	.10	
5.3 Examples of assessment conditions	.25	
5.4 Discussion of specifying assessment conditions, including practical experience with specifying assessment conditions (Exercise 4)	<u>.25</u> 0.85	<u>.40</u> .40
6.0 Step 4: Develop Proficiency Criteria		
6.1 Part 1: Developing performance <i>measures</i>	.25	
6.2 Overview of measurement definition and procedures	.25	
6.3 Definition of performance measures	.25	
6.4 Types of measurement	.25	
6.5 Examples of measurement types	.25	
6.6 Discussion of developing performance measures, including practical experience with developing performance measures (Exercise 5)	<u>.25</u> 1.25	<u>.75</u> .75
6.7 Part 2: Developing performance <i>standards</i>	.25	
6.8 Definition of performance standards	.25	
6.9 Example of performance standards	.25	
6.10 Definition of scoring procedures	.25	
6.11 Examples of types of scoring procedures and standards	.25	
6.12 Discussion of developing performance standards, including practical experience with developing performance standards (Exercise 6)	<u>.25</u> 1.25	<u>.75</u> .75
7.0 Step 5: Prepare Assessment Materials		
7.1 Rationale and process for preparing materials	.25	
7.2 Example assessment form	.25	
7.3 Documentation to be prepared	.25	
7.4 Example materials	<u>.25</u> 1.00	
8.0 Summary		
8.1 Review of steps involved in developing mariner assessments	.25	
8.2 Summary and discussion of goals for the workshop	<u>.25</u> 0.50	
TOTAL	9.60	3.15

Developing Mariner Assessments: A Practical Workshop for Assessment Developers

Developing Mariner Assessments

1 of 150

Workshop Staff Introductions

Developing Mariner Assessments

2 of 150

Participant Introductions

Please tell us briefly:

- Your name
- How you are related to the maritime industry
- What you most want to gain from the course

Developing Mariner Assessments

3 of 150

Project Context

- USCG and industry, increased concern for mariner proficiency in performing shipboard responsibilities
- Project objective to assist USCG and industry by providing tool for assessment
- Considered instructional theory, recent USCG guidance, 1995 IMO STCW amendments

Developing Mariner Assessments

4 of 150

Instructional Theory

- For training, performance-based objectives: conditions, behaviors, standards (as example: IMO model courses)
- For assessment, recent practice:
 - expert judgment of skills, valid
 - paper test of knowledge, reliable
- Develop performance-based assessment procedures, valid and reliable

Developing Mariner Assessments

5 of 150

Recent USCG Guidance

- On company roles and responsibilities regarding STCW (NVIC 4-97)
- On Qualified Instructors and Designated Examiners (NVIC 6-97)
- On USCG/industry partnerships through a Quality Standards System for workshops and training programs (NVIC 7-97)

Developing Mariner Assessments

6 of 150

1995 IMO STCW Amendment

- Requires assessment of mariner competence by demonstration of performance
- Provides required proficiencies, understanding, skills by mariner role
- Provides guidance on assessment methods: shipboard, simulator, laboratory
- Provides guidance on assessor, on using established measures and standards

Developing Mariner Assessments

7 of 150

IMO MSC Circular, May 1998

- Formal assessment of **competence** under authority of approved center
- Conduct of assessment of **proficiencies** by qualified assessor onboard ship
- **Guidance for developing and conducting assessments (similar to project approach)**

Developing Mariner Assessments

8 of 150

Workshop Scope and Audience

- Scope: Tool for developing procedures for assessment of mariner proficiencies
- Audience
 - USCG reviewers
 - USCG-accepted third-party reviewers
 - Training program assessment developers
 - Qualified instructors and designated examiners

NOTE: This workshop does not now meet any IMO, STCW, or USCG requirements.

Developing Mariner Assessments

9 of 150

Workshop Objectives

- Understand validity and reliability
- Demonstrate development of performance-based assessment objectives
- Demonstrate specification of methods, conditions, and exercises
- Understand performance measurement
- Demonstrate development of standards
- Demonstrate preparation of materials

Developing Mariner Assessments

10 of 150

Developing Procedures for Assessment of Mariner Proficiency

Developing Mariner Assessments

11 of 150

Workshop Agenda

Day 1

- The Assessment Development Process
- Assessment Validity and Reliability
- Step 1: Identify Assessment Objectives
- Step 2: Determine Assessment Methods



Developing Mariner Assessments

12 of 150

Workshop Agenda

Day 2

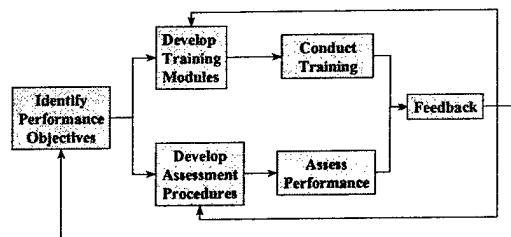
- Step 3: Specify Assessment Conditions
- Step 4: Develop Performance Measures and Standards
- Step 5: Prepare Assessment Materials

Summary/Overview

Developing Mariner Assessments

13 of 150

Instructional Development and Assessment Development

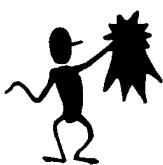


Developing Mariner Assessments

14 of 150

Common Uses of Assessment

- Equipment purchases
- Judging animals in competitions
- Comparing athletic performances
- Evaluating the performance of employees



Developing Mariner Assessments

15 of 150

Assessment Success Stories



- Telecommunications industry
- Pilot training
- Fire fighting
- Tank crew training

Developing Mariner Assessments

16 of 150

Example of Employee Assessment

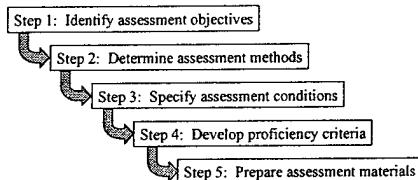
Hamburger Heaven Food Server

Assessment Objective	Performance Standard
Friendly and courteous	Smiles and greets every customer
Speedy service	More than 40 orders per hour
Accurate charging	Less than 1% errors
Accurate order filling	Less than 10% errors

Developing Mariner Assessments

17 of 150

Five Steps of Assessment Development



Developing Mariner Assessments

18 of 150

Validity and Reliability of Mariner Assessments

Developing Mariner Assessments

19 of 150

Validity

- Validity refers to the idea of assessing the performance of interest
- *Example:*
 - Head diameter as an assessment of intelligence has low validity
 - Head diameter as an assessment of a mariner's ability to get his/her head in and out of a port hole has high validity

Developing Mariner Assessments

20 of 150

Valid Assessments

- Include the work equipment (controls, displays, tools) that are required for successful performance
- Provide the cues from the job environment that are used on the job to determine appropriate actions
- Assess skills and knowledge that are critical to successful performance

Developing Mariner Assessments

21 of 150

Case Study: Rules of the Road

Three Assessment Methods

Assessment Method	Description
Multiple-choice test items	Third mate licensing exam items
Situation Assessment	View dynamic simulated situation and determine Rules applicability
Collision Avoidance	Take action on simulated bridge to avoid potential collisions

Developing Mariner Assessments

22 of 150

Case Study: Rules of the Road

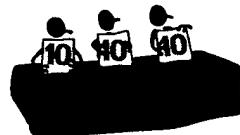
Assessment Method	Validity Issues
Multiple-choice test items	Positive: Covers broad range of topics Negative: Test items can be memorized. Assesses recall of information, not application
Situation Assessment	Positive: More directly resembles bridge watchkeeping requirements Negative: Does not assess collision avoidance
Collision Avoidance	Positive: Resembles additional bridge watchkeeping requirements Negative: Does not assess application of Rules on a real bridge

Developing Mariner Assessments

23 of 150

Reliability

- Reliability refers to the consistency of assessment



Developing Mariner Assessments

24 of 150

Reliable Assessments

- Consist of procedures that are easily repeated between assessments and assessors
- Have well-defined performance measures
- Have well-defined procedures for comparing performance to standards

Developing Mariner Assessments

25 of 150

Case Study: Rules of the Road

Assessment Method

Multiple-choice Items

Reliability Issues

Positive: Items are repeated, minimal assessor involvement, well-defined scoring

Negative: May be misinterpreted

Situation Assessment

Positive: Scenario is repeated, minimal assessor involvement, well-defined scoring

Negative: Limited number of scenarios, artificial setting may make interpretation difficult

Collision Avoidance

Positive: Scenarios always start the same

Negative: Scenarios vary with maneuvers, well-defined scoring is difficult (but feasible)

Developing Mariner Assessments

26 of 150

Validity and Reliability of Mariner Assessment



- Are valid and reliable assessment procedures a practical goal in the maritime industry?
- What are the main obstacles to valid and reliable assessment of mariners?
- How can we best address these obstacles?

Developing Mariner Assessments

27 of 150

Exercise 1: Understanding Assessment Validity and Reliability

- Hamburger Heaven Server Training and Assessment
 - Candidates receive a full day of training at Hamburger Limbo.
 - Candidates must successfully complete Hamburger Limbo assessment in order to advance to a probationary position at Hamburger Heaven.



Developing Mariner Assessments

28 of 150

Exercise 1, continued

The first four hours at Hamburger Limbo is a series of lectures addressing:

- Hamburger Heaven mission and vision
- Hamburger Heaven profit goals
- Worker safety
- Server's attire and hygiene requirements
- Four standards of Hamburger Heaven server performance

Developing Mariner Assessments

29 of 150

Exercise 1, continued

The four standards of Hamburger Heaven server performance are:

- Smile and greet every customer
- 40+ orders taken per hour
- Less than 1% charging errors
- Less than 10% order filling errors

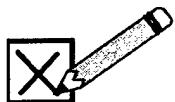
Developing Mariner Assessments

30 of 150

Exercise 1, continued

The final four hours in Hamburger Limbo is a four-part assessment:

1. Computer administered multiple-choice test
2. Greeting assessment
3. Order taking assessment
4. Order filling assessment



Developing Mariner Assessments

31 of 150

Exercise 1, continued

- We will assist in forming small work groups
- Each group should review the four assessment procedures and provide comments and recommendations on:
 - Positive & negative validity issues
 - Positive & negative reliability issues
 - Recommended assessment procedure improvements for validity and reliability

Developing Mariner Assessments

32 of 150

Exercise 1: Example Solution

Developing Mariner Assessments

33 of 150

Step 1: Specify Assessment Objectives

Developing Mariner Assessments

34 of 150

Steps in Specifying Assessment Objectives

1. Select proficiency to be assessed
2. Identify regulatory requirements
3. Analyze job requirements
4. Describe individual assessment objectives

Developing Mariner Assessments

35 of 150

Identify Regulatory Requirements

- Identify specific requirement in STCW code
- 5 levels of requirements in STCW code:
 - Chapter
 - Table
 - Function
 - Competence
 - Proficiency

Developing Mariner Assessments

36 of 150

STCW Code

Competencies: Function onboard ship
Knowledge, Understanding, Proficiency: Specific skill and knowledge requirements



Developing Mariner Assessments

37 of 150

Analyze Job Requirements

- Identify job requirements using available sources
- Document sources
- Identify critical job requirements
- Make sure the assessment procedure meets STCW requirements and is practically feasible

Developing Mariner Assessments

38 of 150

Sources of Mariner Task Information

- STCW competencies, knowledge, understanding, and proficiency
- U.S. Code of Federal Regulations
- Job or task analysis
- Subject matter expert knowledge and judgment
- Technical manuals
- Bargaining agreements

Developing Mariner Assessments

39 of 150

Job or Task Analysis

Job Description: General responsibilities and duties

Task Description: Specific activities with identifiable beginning, action, output

Task Criticality: Identification of tasks critical to successful job performance

- Frequency
- Importance

Developing Mariner Assessments

40 of 150

Collection of Job/Task Data

1. Determine the job to be analyzed
2. Prepare the data collection plan
3. Gather initial data
4. Prepare data collection forms
5. Select sample and arrange data collection
6. Collect data
7. Consolidate data into lists of tasks with criticality
8. Validate task list and determine skill and knowledge requirements
9. Finalize list

Developing Mariner Assessments



41 of 150

Subject Matter Experts (SMEs)

- Provide initial input in task analysis
- Provide a substitute or shortcut to formal task analysis
- SME sources
 - Current jobholders
 - Supervisors
 - Instructors
 - Former jobholders
 - Others familiar with job

Developing Mariner Assessments

42 of 150

Describe Individual Assessment Objectives

- State individual objectives
- Describe assessment conditions
- Identify special characteristics
- Describe mariner actions

Developing Mariner Assessments

43 of 150

Assessment Objectives . . .

- May address either:
 - *Skills & abilities*: behaviors that must be applied in successful performance of job activities
 - *Knowledge*: learned concepts, cues, facts, rules, & procedures that are necessary for proficient performance of a task
- Should address critical job requirements
- Should address prerequisite training and experience

Developing Mariner Assessments

44 of 150

Standard Format for Objectives

- Assessment objectives should describe what the mariner needs to perform to successfully complete the assessment
- When writing assessment objectives, make sure you capture:
 - action
 - preliminary conditions
 - preliminary standard(s)

Developing Mariner Assessments

45 of 150

Example Objective: ARPA

Using ARPA under conditions of relatively complex and varied traffic conditions, calculate required new course for vessel to maintain a minimum CPA between own ship and other vessels.



Developing Mariner Assessments

46 of 150

Example Objective: Performance of Lookout Procedures

Specification from 1995 STCW Code:

STCW Table A-II/4: Mandatory minimum requirements for certification of ratings forming part of a navigational watch

STCW Function: Navigation at the support level

STCW Competence: Keep a proper lookout by sight and hearing

STCW Proficiency: Responsibilities of a lookout, including reporting the approximate bearing of a sound signal, light or other object in degrees or points

Developing Mariner Assessments

47 of 150

Assessment Objectives for Lookout Procedures

1. Describe lookout duties & responsibilities
2. Identify lookout stations & safe routes onboard
3. Describe & identify international distress signals
4. Demonstrate lookout techniques & make lookout reports in clear visibility during daylight
5. Demonstrate lookout techniques & make lookout reports in clear visibility at night

Developing Mariner Assessments

48 of 150

Assessment Objectives for Lookout Procedures (continued)

6. Demonstrate lookout techniques & make lookout reports in restricted visibility during daylight or at night
7. Demonstrate the use of lookout equipment
8. Demonstrate man overboard procedures
9. Demonstrate lookout watch relief procedures

Developing Mariner Assessments

49 of 150

Comparison of Simulator and Shipboard Assessment



- How would you need to identify assessment objectives differently if you were assessing via simulation and shipboard assessment?
 - ARPA example
 - Lookout Procedures example

Developing Mariner Assessments

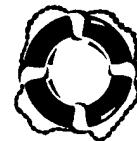
50 of 150

Exercise 2: Specifying Assessment Objectives

- **Goal:** To specify six lifeboat launching assessment objectives
- **Tools:**
 - STCW and CFR Lifeboat Competencies
 - Lifeboat Launching Procedure
 - Examples:
 - Lookout Procedures
 - ARPA
 - Assessment Objectives Worksheet

Developing Mariner Assessments

51 of 150



Exercise 2, continued

- To get started:
 - Review the STCW/CFR competencies
 - Review the lifeboat task data
 - Use the above & your knowledge of best practices as the basis for your objectives
 - Use the Lookout and ARPA examples as a guide for the format of your objectives

Developing Mariner Assessments

52 of 150

Exercise 2, continued

- Your assessment objectives should include:
 - Action
 - Preliminary conditions
 - Preliminary standard(s)
- Example:
 - Given relatively complex and varied traffic (*condition*), using ARPA calculate the required new course for own ship (*action*) to maintain a minimum CPA between own ship and other vessels (*standard*).

Developing Mariner Assessments

53 of 150

Exercise 2, continued

- Use the overhead transparency worksheet to record your group's answers.
- Select a spokesperson to tell the larger group your assessment objectives.
- You have 30 minutes for this exercise

Developing Mariner Assessments

54 of 150

Exercise 2: Example Solution

- Many correct responses
- Solution gives example of 6 possible objectives
- Example objective:
 - Given a stowed lifeboat and 4 cadets (*conditions*), person in charge uses proper commands and terminology (*standard*) to carry out inspections of lifeboat, falls and davit (*action*).

Developing Mariner Assessments

55 of 150

Step 2: Determine Assessment Methods

Developing Mariner Assessments

56 of 150

Steps in Determining Assessment Methods

1. Identify alternative assessment methods
2. Review advantages, disadvantages, and feasibility of alternatives
3. Consider performance to be assessed and review validity and reliability issues
4. Determine assessment method

Developing Mariner Assessments

57 of 150

Basic Assessment Methods

- Written or oral test questions
- Simulation using mock equipment
- Simulation using actual equipment
- Shipboard assessments

Developing Mariner Assessments

58 of 150

Written or Oral Test Questions



- Open-ended
- Fill-in the blank
- Multiple-choice
- Essay/discussion

Developing Mariner Assessments

59 of 150

Characteristics of Simulation

- Environment
- Controls
- Displays
- Processing Characteristics
 - Hydrodynamics
 - Mimicry of electronic processing

Developing Mariner Assessments

60 of 150

Shipboard Assessment

- Actual or dedicated training/assessment equipment
- Operational or non-operational conditions
- More/less demanding operational conditions

Pros and Cons of Assessment Methods

Assessment Method	Pros	Cons
Written or oral test questions	<ul style="list-style-type: none">• Easy to create• Easy to standardize• Easy to test many candidates• Good for measuring knowledge	<ul style="list-style-type: none">• May have poor similarity to work environment• Candidate needs good verbal skills
Simulation using mock equipment	<ul style="list-style-type: none">• High control• Safe	<ul style="list-style-type: none">• May be expensive• May have poor work similarity• Substantial assessor requirements
Simulation using actual equipment	<ul style="list-style-type: none">• High control• Safe• May have good work similarity	<ul style="list-style-type: none">• May be expensive• Substantial assessor requirements
Shipboard	<ul style="list-style-type: none">• May be inexpensive• Uses actual work setting	<ul style="list-style-type: none">• Substantial assessor requirements• Operational scheduling conflicts• Difficult to standardize and score• Task may be infrequent or dangerous

Consider Performance to be Assessed

- Review assessment objectives
- Consider task initiation
- Consider the performance product
- Consider the performance process

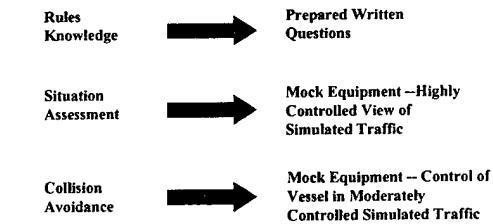
Review Validity and Reliability Issues

- Review realism (validity) requirements
 - Environment/setting
 - Controls
 - Displays
 - Processing Characteristics
- Review control (reliability) required
 - Key skill and knowledge requirements
 - Variability of task conditions
 - Comparability of assessment conditions

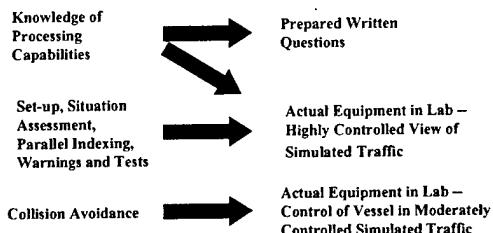
Review Feasibility of Alternatives

- Can performance be measured via written assessment?
- Can performance be easily and safely elicited onboard?
- Can a simulator replicate conditions closely enough to cue the behavior?
- Which is easier, cheaper, safer, more legally defensible?

Assessment Method Example: Rules of the Road



Assessment Method Example: ARPA Operation



Developing Mariner Assessments

67 of 150

Assessment Method Example: Lookout Procedures

- Assessment Requirements
 - Knowledge of lookout duties & procedures
 - Correct use and operation of lookout techniques, reporting, & equipment
- Assessment Constraints
 - Must not interfere with vessel safety
 - Equipment must be present & operational
 - Conditions of clear (day, night) & restricted visibility
- Assessment Method Selection
 - Written test to assess knowledge of duties
 - Shipboard or simulator assessment of operations

Developing Mariner Assessments

68 of 150

Exercise 3: Determining Assessment Methods

- Goal:** To determine the appropriate assessment methods for six lifeboat launching assessment objectives
- Tools:**
 - “Pros and Cons of Basic Assessment Methods”
 - Lookout Procedures example
 - Assessment methods worksheet

Developing Mariner Assessments

69 of 150

Exercise 3, continued

- To get started:
 - Remember the basic assessment methods:
 - Written or oral tests
 - Simulation in controlled lab using mock equipment (e.g., PC-based interface)
 - Simulation in controlled lab using actual equipment
 - Shipboard assessment
 - Review the pros and cons of each method (Attachment 1)

Developing Mariner Assessments

70 of 150

Exercise 3, continued

- Record your group's answers on your overhead transparency worksheet
- Select a spokesperson to report your assessment methods
- You have 15 minutes



Developing Mariner Assessments

71 of 150

Exercise 3 - Summary

- Considerations in assessment method selection:
 - Appropriateness of written, knowledge-based assessment
 - Availability of actual equipment (lifeboat, davit)
 - Operational safety
 - Possibility of damaging vessel's lifesaving equipment
 - Ability to vary conditions on equipment

Developing Mariner Assessments

72 of 150

Step 3: Specify Assessment Conditions

Developing Mariner Assessments

73 of 150

Steps in Specifying Assessment Conditions

1. Describe operational settings and scenarios
2. Specify oral and written test questions
3. Provide the cues used in selecting and executing performance (validity)
4. Standardize assessment conditions (reliability)

Developing Mariner Assessments

74 of 150

Issues to Consider

- What must be presented to the candidate as cues to initiate task?
- What must be presented to the candidate to make decisions?
- What actions must be taken by the candidate?
- What assessment objectives will require written or oral questions?

Developing Mariner Assessments

75 of 150

Conditions Requiring Specification

- Candidate orientation
- Equipment, apparatus, and tools
- Initial equipment settings or scenarios
- Written or oral questions



Developing Mariner Assessments

76 of 150

Assessment Conditions Example: Rules of the Road

- Candidate orientation
 - 30-minute orientation of workstation operation
 - Practice session with workstation
- Equipment, apparatus, and tools
 - PC-based bridge simulator
- Initial equipment settings or scenarios
 - Situation observation scenarios (first parts)
 - Collision avoidance (second parts)
- Written or oral questions
 - Factual questions

Developing Mariner Assessments

77 of 150

Assessment Conditions Example: ARPA Operation

- Candidate orientation
 - ARPA set-up instructions
- Equipment, apparatus, and tools
 - Full-scale ARPA simulator
 - Vessel cards
- Initial equipment settings or scenarios
 - Situation observation scenarios (first parts)
 - Collision avoidance (second parts)
- Written or oral questions
 - Target information forms
 - Factual questions

Developing Mariner Assessments

78 of 150

Assessment Conditions Example: Lookout - *Lookout Assessment Objective 4*

Assessment Objective	4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment
Candidate Orientation	Assessor briefs candidate on assessment methods, conditions, and standards
Required Equipment, Apparatus, &/or Tools	Lookout station equipped with an internal communications system, ship's bell, 7x50 binoculars, and bearing repeater fitted w/ bearing/ azimuth circle, alidade, or pelorus. The lookout station should be clear, and the examiner must be able to observe activities.
Initial Conditions	Conduct assessment in clear visibility during daylight. Ensure reportable objects are in sight.

Developing Mariner Assessments

79 of 150

Comparison of Simulator and Shipboard Assessment

- What are some of the challenges in controlling conditions for simulator and shipboard assessment?
 - Providing the cues used in selecting and executing performance (validity)
 - Standardizing assessment conditions (reliability)

Developing Mariner Assessments

80 of 150

Exercise 4: Specifying Assessment Conditions

- **Goal:** To specify conditions for your lifeboat launching assessment
- **Tools:**
 - Group responses to Exercises 2-3
 - Lookout and ARPA examples
 - Assessment conditions worksheet

Developing Mariner Assessments

81 of 150

Exercise 4, continued

- To get started:
 - Review the lifeboat launching assessment objective given to your group
 - Consider the preliminary conditions and method(s) you specified for this objective
 - Use the Lookout & ARPA examples as a guide
- ARPA example has:
 - Detailed exercise conditions
 - Assessor and candidate instructions

Developing Mariner Assessments

82 of 150

Exercise 4, continued

- ARPA Example:
 - Assumes assessment in controlled lab using full-scale functional ARPA
 - “Exercise E” is one of 7 exercises candidate performs
 - Scenario is programmed ahead of time into simulator by assessor
 - Narrow channel navigation with cross-current
 - Own ship is outbound
 - One threat vessel is inbound

Developing Mariner Assessments

83 of 150

Exercise 4, continued

- Candidate assessed on objective 1.6 - “Understanding of when to use ground- or sea-stabilized modes, and when to use north- up, course-up and head-up presentations”
- Candidate given
 - full-scale ARPA simulator
 - vessel card
 - chartlet
 - exercise instructions
 - worksheet to record vessel data & response to written question

Developing Mariner Assessments

84 of 150

Exercise 4, continued

- Assessor given:
 - Instructions for how to program simulator
 - Instructions for how to administer assessment

Exercise 4, continued

- Record your conditions on the transparency:
 - Identify setting
 - Identify what must be presented to candidate (display)
 - Identify candidate action items
 - Identify objectives requiring questions
- Select a spokesperson
- You have 20 minutes

Exercise 4: Example Solution

- Assessment to be conducted at sea during weekly abandon ship drill
- Weather & sea conditions conducive to safe assessment
- Assessment begins with lifeboat in stowed position
- Assessor varies equipment:
 - Unfastens sea painter from thwart
 - Secures one tricing pendant incorrectly

Exercise 4: Example Solution, continued

- Assessor makes sure candidate and crew members have life jackets on
- Assessor briefs candidate on assessment objectives and standards
- Assessor has a checklist of candidate action items and standards of performance
- Assessor completes checklist as candidate performs lifeboat launching

Step 4: Develop Proficiency Criteria

Part 1: Develop Performance Measures

Measures and Standards

Measure	Standard
Correct charging	99%
Correct order filled	90%
CPA	More than 0.25 nm
ARPA set-up time	Less than 5 minutes

Developing Performance Measures & Standards

- Match performance measures to the assessment objectives
- Refine each performance measure



Developing Mariner Assessments

91 of 150

Definition of Measurement

- Measurement is applying rules to assign categories or numbers to different levels or degrees
- Categories and numbers represent levels
- Rules help make categories or numbers comparable

Developing Mariner Assessments

92 of 150

Performance Measures

- *Performance measures* are procedures for observing and recording a candidate's performance
- Measures can be objective or subjective
- Measures can focus on the process or product of performing the task
- Try to measure the performance required to meet an objective in more than one way to increase validity and reliability

Developing Mariner Assessments

93 of 150

Measurement Types

Type of Measurement	Activity	Measure
Objective	Speed Skating	Time to Finish
Subjective Rating	Figure Skating	Technical & Artistic Merit
Subjective Checklist	Fast Track Racing	Finish Race or Not

Developing Mariner Assessments

94 of 150

Types of Measurement

Different types of measurement give you different amounts of information

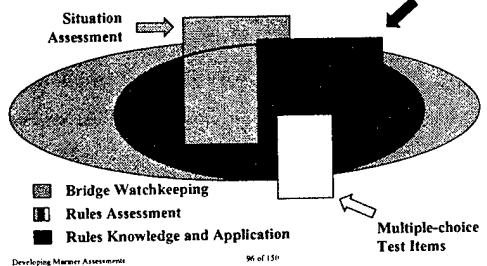
Types/Info.	Amount Different	Relative Performance	Group Member
Objective	●	●	●
Rating		●	●
Checklist			●

Developing Mariner Assessments

95 of 150

Measuring What You Want to Measure

Rules Knowledge and Application

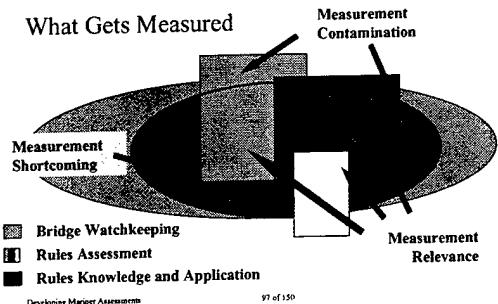


Developing Mariner Assessments

96 of 150

Measuring What You Want to Measure

What Gets Measured



Developing Mariner Assessments

97 of 150

Example of Checklist Measure

Lookout Assessment Objective 4: Demonstrate lookout techniques and make lookout reports in clear visibility during daylight

- 4.1 List the sightings that should be reported when detected
- 4.2 Report sighted objects using ship's bell
- 4.3 Report sighted objects verbally using degrees
- 4.4 Report sighted objects verbally using points
- 4.5 Report sky objects verbally using points
- 4.6 Report audible target verbally using points

Developing Mariner Assessments

98 of 150

Example of Rating Measure

USMMA Cadet Watch Team Measure Examples

Measure	Rating
Compliance with Master's/Standing Orders	0, 1, 2
Proper Preparation for Arrival	0, 1, 2
Proper Internal Communications	0, 1, 2
Proper vhf Procedures	0, 1, 2
Master/Engine Room Kept Informed	0, 1, 2

Developing Mariner Assessments

99 of 150

Example of Objective Measure

ARPA — Situation Assessment

Target Data	Measure
Bearing	Degrees from Actual
Range	Nm from Actual
Course	Degrees from Actual
Speed	Nm from Actual
CPA	Nm from Actual
TCPA	Seconds from Actual

Developing Mariner Assessments

100 of 150

Comparison of Simulator and Shipboard Assessment

- How would you need to develop performance measures differently if you were developing procedures for simulator and shipboard assessment?

Developing Mariner Assessments

101 of 150

Exercise 5: Developing Performance Measures

- **Goal:** To develop performance measures for up to six lifeboat launching assessment objectives
- **Tools:**
 - Your group responses to Exercises 2-4
 - Rules of the Road example
 - Lookout duties example
 - Worksheet

Developing Mariner Assessments

102 of 150

Exercise 5, continued

- To get started:
 - Consider your lifeboat launching assessment objectives
 - Define specific performance measures for each objective
 - Remember that measures describe *observable actions* or *outcomes* and that they may be *objective* or *subjective*
 - Include both process and product measures
 - Please do not develop standards at this time

Developing Mariner Assessments

103 of 150

Exercise 5, continued



Developing Mariner Assessments

104 of 150

- See Attachments 1 & 2 for examples of performance measures for other types of assessments
- Record your group's answers on the overhead transparency
- Select a spokesperson
- You have 45 minutes

Exercise 5: Example Performance Measures

- Following is based on task information given in "Launching Procedure for a Gravity Davit Lifeboat"
- Candidate:
 - Inspects releasing gear
 - Checks releasing gear lever
 - Inspects tricing pendant, sea painter
 - Checks drain plug
 - Inspects general conditions, arrangement of lifeboat equipment
 - Inspects man ropes, davit tracks, frapping lines
 - Locates hand crank
 - Communicates with other crew members clearly using proper terminology
- After each task, candidate reports to assessor on each measure

Developing Mariner Assessments

105 of 150

Step 4: Develop Proficiency Criteria, continued

Part 2: Develop Performance Standards

Measures and Standards

Measure	Standard
Correct charging	99%
Correct order filled	90%
CPA	More than 0.25 nm
ARPA set-up time	Less than 5 minutes

Developing Mariner Assessments

107 of 150

Performance Standards

- Performance standards are the criteria established as acceptable or target levels
 - Individual measure
 - Set of measures used to assess proficiency
- Performance standards incorporate:
 - Measure type
 - Specific performance measure
 - Specific assessment conditions

Developing Mariner Assessments

108 of 150

Performance Standards Example

- Specifications for equipment purchase
 - Determine requirements and objectives
 - Establish specifications (standards)
 - Purchase equipment
 - Check out equipment

Developing Mariner Assessments

110 of 150

Developing Performance Standards

- Identify candidate action or outcome
- Select/define measure
- Define general standard strategy
- Get input & reach consensus on standard for each measure
- Set acceptable range/develop precise definition for standards

Developing Mariner Assessments

110 of 150

Pass/Fail vs. Graded Standards

- Pass/Fail standards establish a minimum level of required ability
- Graded standards establish levels of performance

Developing Mariner Assessments

111 of 150

Graded vs. Pass/Fail Standards

Measure Used in Standard				
Standard	Objective	Rating	Checklist	
Graded	●	●	●	
Pass/Fail			●	

Developing Mariner Assessments

112 of 150

Developing Standards for a Single Performance Measure

- Basis (graded vs. pass/fail)?
- Who establishes scoring procedures?
- What is the process for gaining agreement on the standard?

Developing Mariner Assessments

113 of 150

Example of Single Pass/Fail Standard

Lookout Assessment Objective 4

PASS FAIL

4.1 **Measure:** Answers "Identify 6 of the sightings that should be reported when detected by the lookout." Standard: Correct response includes 6 from a list of appropriate responses

4.2 **Measure:** Reports sighted objects using ship's bell Standard: Reports at least 3 surface objects using ship's bell. Improper reporting constitutes failure. Failure to detect visible objects within a specified sector of view constitutes failure.

4.3 **Measure:** Reports sighted objects verbally using degrees Standard: Verbally reports at least 3 surface objects. Reports must be within 22-1/2° of actual bearing.

(Continued)

Example of Single Graded Standard

Rules CPA Measures and Standards for Selected Scenario

Minimum CPA	Rating
Greater than 0.5 nm	Expert
Between 0.25 and 0.5 nm	Qualified
Less than 0.25 nm	Unqualified

Developing Mariner Assessments

115 of 150

Scoring Procedures

- Combine multiple measures and standards
- Define proficiency in a selected area of assessment

Developing Mariner Assessments

116 of 150

Types of Scoring Procedures

IF the knowledge, skill, or ability being measured is...	THEN, scoring procedures should be developed that apply...
essential to safe and/or effective job performance	a pass/fail approach
useful in safe and/or effective job performance, but other mariner capabilities could readily compensate	a graded approach

Developing Mariner Assessments

117 of 150

Developing Standards for Combined Performance Measures

- Identify measures & standards of *critical* and *non-critical* job requirements
- Determine if measures should be combined
NO: Multiple criteria for separate measures
YES: Single criteria for combined measures
- Develop pass/fail & graded scoring procedures
- Develop comprehensive proficiency criterion across all measures

Developing Mariner Assessments

118 of 150

Developing Combined Standards Example: Hamburger Heaven

- Multiple criteria for separate measures
 - If candidate fails any standard, DO NOT HIRE

Developing Mariner Assessments

119 of 150

Developing Performance Standards Example: *Lookout Assessment Objective 4*

Measure	Standard	Score
1. Identifies six reportable sightings	Correctly reports six of appropriate sightings (from list)	Pass/ Fail
2. Reports sighted objects using ship's bell	Correctly reports at least 3 surface objects using ship's bell	Pass/ Fail
3. Reports sighted objects verbally using degrees	Correctly reports at least 3 surface objects, within 22-1/2° of actual bearing	Pass/ Fail
4. Reports sighted objects visually using points	Correctly reports at least 3 surface objects within ± 2 points of actual bearing	Pass/ Fail
5. Reports sky objects verbally using points	Correctly reports at least 3 sky objects within ± 2 pts. of actual bearing	Pass/ Fail
6. Reports audible targets verbally using points	Correctly reports at least 3 audible targets within ± 2 pts. of actual bearing	Pass/ Fail

Combined Standard: Candidate must pass each measure to pass objective.

Developing Mariner Assessments

120 of 150

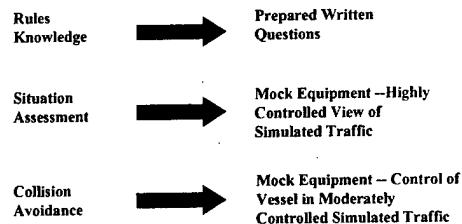
Combined Standards for Lookout

- Candidate must successfully perform each action identified under an assessment objective to pass that objective
- Candidate must pass each of the nine lookout assessment objectives in order to pass the assessment and demonstrate proficiency in lookout duties

Developing Mariner Assessments

121 of 150

Rules of the Road Example (Review)

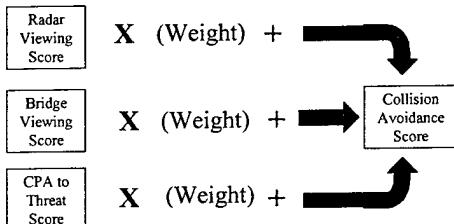


Developing Mariner Assessments

122 of 150

Developing Standards Example: Rules of the Road-1

- Collision Avoidance Score (simplified)



Developing Mariner Assessments

123 of 150

Collision Avoidance Proficiency Standard

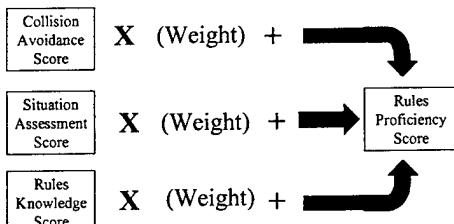
- Maximum Score = 20
- Standard for Proficiency = 10

Developing Mariner Assessments

124 of 150

Developing Standards Example: Rules of the Road-2

- Collision Avoidance + Situation Assessment + Knowledge



Developing Mariner Assessments

125 of 150

Rules of the Road Proficiency Standard

- Maximum Score = 60
- Standard for Proficiency = 35

Developing Mariner Assessments

126 of 150

Comparing Simulator and Shipboard Assessment

- How would you need to develop performance standards differently if you were assessing via simulator or shipboard assessment?



Developing Mariner Assessments

127 of 150

Exercise 6: Developing Performance Standards

- Goal:** To develop performance standards for up to three lifeboat launching assessment objectives
- Tools:**
 - Performance measures developed in Ex. 5
 - Examples
 - Rules of the Road
 - Lookout

Developing Mariner Assessments

128 of 150

Exercise 6, continued

- To get started:
 - Consider performance measures you developed
 - Specify a scoring strategy for each measure
 - Pass / fail
 - Graded (e.g., *expert, qualified, not qualified*)
- Determine who should be included in consensus-gathering meeting

Developing Mariner Assessments

129 of 150

Exercise 6, continued

- Determine standard(s) for each measure
- Specify your rationale
- Note how you would combine measures for a single objective
- Discuss development of measures/objectives into a combined proficiency criterion
- Record solution on your transparency
- Select a spokesperson
- You have 45 minutes

Developing Mariner Assessments

130 of 150

Exercise 6: Example Solution

- Assume shipboard inspection of Objective #1 - "person in charge carries out proper inspections"
- Use graded level scoring & define levels
 - Expert:** Measure accomplished correctly, efficiently, without hesitation, using proper terminology
 - Qualified:** Measure accomplished correctly with some thought and hesitation. Minor mistakes in terminology may be made.
 - Not qualified:** Measure not accomplished, or accomplished incorrectly. Incorrect terminology used, which may result in misunderstandings.

Developing Mariner Assessments

131 of 150

Exercise 6: Example Solution, continued

- Example performance measures & standards
 - Measure:** Candidate properly inspects, or supervises the inspection of, releasing gear.
 - Standard:** Candidate correctly reports the condition of the releasing gear.
 - Measure:** Candidate locates hand crank.
 - Standard:** Candidate correctly reports proper location of hand crank.

Developing Mariner Assessments

132 of 150

Step 5: Prepare Assessment Materials

Developing Mariner Assessments

133 of 150

Steps in Preparing Assessment Materials

1. Prepare detailed assessment worksheets
2. Prepare assessor instructions
3. Prepare candidate instructions
4. Finalize written and oral test questions
5. Finalize simulator and/or shipboard procedures
6. Document references, source materials, and validation process

Developing Mariner Assessments

134 of 150

Template for Assessment Form

Section 1. Assessment Parameters

Assessment Objectives	<ul style="list-style-type: none">Describe lookout duties and responsibilitiesIdentify lookout stations and safe routes underwayDescribe and identify the international distress signals
Assessment Method	Oral or written examination
Candidate Orientation	Examiner briefs the candidate on assessment methods, conditions, and standards
Required Equipment, Apparatus, and/or Tools	Examination proctor, test instrument, answers, and associated references
Initial Conditions	This assessment may be conducted either before or after the practical demonstration of lookout skills.

Section 2. Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1. Describe lookout duties and responsibilities	Answer question: What are the duties and responsibilities of the lookout?	Specifies that a lookout's duties are: sighting, identifying, and accurately reporting to the responsible authority all objects or sounds detected.	<ul style="list-style-type: none">PassFail

Comments:

Developing Mariner Assessments

135 of 150

Prepare Documentation

- Documentation provides a basis for external review & simplifies updating in the future
- Documentation should include:
 - Source of assessment objectives plus mapping between objectives, conditions, and measures
 - Standards and source of standards
 - Detailed procedures for conducting assessment
 - Assessment items, assessor materials, candidate materials, and performance measurement procedures

Developing Mariner Assessments

136 of 150

ARPA Assessment Example: Assessment Objectives

ARPA Assessment: Situation Assessment

1. Understanding the criteria for the selection of targets by automatic acquisition
2. Appreciation of the uses, benefits and limitations of ARPA operational warnings
3. Detection and identification of false echoes, sea return, racons, and SARTs
4. The use of graphic representation of danger areas
5. Knowledge and recognition of historic data as a means of indicating recent maneuvering of targets

Developing Mariner Assessments

137 of 150

ARPA Assessment Example: Assessment Conditions

General Description: Fully functional ARPA in laboratory setting using several pre-designed operational exercises

Description of Exercise A

- Open waters scenario with mix of other vessels
- Own ship and Target *E* maneuver
- Target *D* reduces speed
- Target *C* is lost, resulting in lost target alarm actuation

Developing Mariner Assessments

138 of 150

ARPA Assessment Example: Assessor Instructions

Detailed Assessor Instructions for Exercise A

1. Before candidates arrive, de-initialize ARPA units so speed and compass settings are incorrect.
2. Before getting underway, verify that each candidate has correctly initialized the ARPA unit.
(more detail provided)
3. Ask each student to demonstrate the available display presentations and display modes.
(more detail provided)

Continues for 11 specific assessor steps

Developing Mariner Assessments

139 of 150

ARPA Assessment Example: Candidate Materials

Description of Exercise A Candidate Materials

- Vessel data card
- Set-up instructions
- Target data forms
- ARPA facsimile showing vessel history trails
- Several questions addressing interpretation of vessel history trails

Developing Mariner Assessments

140 of 150

ARPA Assessment Example: Measures and Standards

- Performance Scoring
 - Standards for individual measures provided
- Score Weighting
 - Means of summing/combining scores (TBD)
- Proficiency Standard
 - Overall standard for ARPA proficiency (TBD)

Developing Mariner Assessments

141 of 150

Lookout Assessment Example: Assessment Objectives

1. Describe lookout duties & responsibilities
2. Identify lookout stations & safe routes onboard
3. Describe & identify international distress signals
4. Demonstrate lookout techniques & make lookout reports in clear visibility during daylight
5. Demonstrate lookout techniques & make lookout reports in clear visibility at night
6. Demonstrate lookout techniques & make lookout reports in restricted visibility during daylight or at night
7. Demonstrate the use of lookout equipment
8. Demonstrate man overboard procedures
9. Demonstrate lookout watch relief procedures

Developing Mariner Assessments

142 of 150

Lookout Assessment Example: Assessment Conditions

Lookout Assessment Objective 4:

- Lookout station equipped with internal communications system, ship's bell, 7x50 binoculars, and bearing repeater. Lookout station should be clear and Assessor must be able to observe activities.
- Conduct in clear visibility during daylight.
- Assessor should ensure that reportable objects are in sight.

Developing Mariner Assessments

143 of 150

Lookout Assessment Example: Candidate & Assessor Materials

Candidate Materials:

- *Candidate Instructions*
- *Assessment Control Sheet*

Assessor Materials:

- *Assessor Instructions*
- *Assessment Worksheets*
- *Assessment Control Sheet*

Developing Mariner Assessments

144 of 150

Lookout Assessment Example: Measures and Standards

<i>Lookout Assessment Objective 4</i>		Standard	Score
Measure			
1. Identifies six reportable sightings	Correctly reports six of appropriate sightings (from list)	Pass/ Fail	
2. Reports sighted objects using ship's bell	Correctly reports at least 3 surface objects using ship's bell	Pass/ Fail	
3. Reports sighted objects verbally using degrees	Correctly reports at least 3 surface objects, within 22-1/2° of actual bearing	Pass/ Fail	
4. Reports sighted objects visually using points	Correctly reports at least 3 surface objects within \pm 2 points of actual bearing	Pass/ Fail	
5. Reports sky objects verbally using points	Correctly reports at least 3 sky objects within \pm 2 pts. of actual bearing	Pass/ Fail	
6. Reports audible targets verbally using points	Correctly reports at least 3 audible targets within \pm 2 pts. of actual bearing	Pass/ Fail	

Developing Mariner Assessments

145 of 150

Comparison of Simulator and Shipboard Assessment

- How would you need to prepare the assessment materials differently if you were using simulation or shipboard assessment?

Developing Mariner Assessments

146 of 150

Summary

Developing Mariner Assessments

147 of 150

Steps in Developing Mariner Assessments

1. Specify Assessment Objectives
 - Identify regulatory requirements
 - Analyze job requirements
 - Describe individual assessment objectives
2. Determine Assessment Methods
 - Identify alternative assessment methods
 - Review advantages & disadvantages
 - Define assessment methods
3. Specify Assessment Conditions
 - Describe operational settings & scenarios
 - Specify written & oral questions

Developing Mariner Assessments

148 of 150

Steps in Developing Mariner Assessments (continued)

4. Develop Proficiency Criteria
 - Identify components of assessment objectives
 - Develop measures & standards
 - Develop scoring procedures & proficiency criteria
 - Validate measures, standards, procedures & criteria
5. Prepare the Assessment Materials
 - Prepare detailed assessment worksheets
 - Prepare assessor & candidate instructions
 - Finalize written & oral questions
 - Finalize simulator &/or shipboard procedures
 - Document references, source materials, & validation

Developing Mariner Assessments

149 of 150

Concluding Remarks

- This workshop presents a thorough overview of the assessment development process.
- Accompanying materials provide greater detail and should be referred to as needed.

Developing Mariner Assessments

150 of 150

EXERCISE 1

Understanding Validity and Reliability

Time: 30 minutes

Purpose: Practice reviewing factors that influence assessment validity and reliability

Outcome: A list of positive and negative validity and reliability issues for each assessment procedure, as well as recommended changes to improve assessment validity and/or reliability

Report: Provide a review of findings and recommendations for one assessment procedure (3 minutes)

Instructions:

A. The goal of this exercise is to gain an understanding of the important concepts of validity and reliability, as they pertain to the development of assessment procedures.

Your tools for this exercise are:

- Lecture slides on validity and reliability.
- Attachment 1, *Hamburger Limbo Assessment Procedures*.
- Attachment 2, *Validity and Reliability Review of Hamburger Limbo Assessment Procedures*.

B. To get started, get in your small groups and read Attachment 1. Carefully consider all aspects of the portion of the Hamburger Heaven assessment that your group is assigned. As a small group, come up with:

- Positive and negative validity issues.
- Positive and negative reliability issues.
- Recommended improvements for validity and reliability.

In conducting your review, focus on the general assessment content and format and consider how these affect validity and reliability. Please DO NOT concern yourselves with the standards that may be applied for passing and failing each assessment (this will be considered later).

Use Attachment 2 to develop a draft of your ideas; record your group's final answers on your overhead transparency worksheet.

C. Select a spokesperson to present your review to the larger group.

EXERCISE 1

Attachment 1

Hamburger Limbo Assessment Procedures

Hamburger Heaven employee candidates receive a full day of training at Hamburger Limbo. Candidates must successfully complete the following four-part Hamburger Limbo assessment in order to advance to a probationary position at Hamburger Heaven:

1. Computer Administered Multiple-choice Test

- Candidates are administered a multiple-choice test using an MS Windows-based test administration and scoring software program.
- The program requires no keyboard skills. Candidates only need to use the cursor control (mouse) to select their answer to each question and scroll down the screen to view the additional questions.
- The multiple-choice test items consist of 50 questions. Ten items are included from each of the following topics:
 1. Hamburger Heaven mission and vision.
 2. Hamburger Heaven profit goals.
 3. Worker safety.
 4. Server's attire and hygiene requirements.
 5. The four standards of Hamburger Heaven server performance.
- When each question is answered, candidates are not allowed to change their response.
- When all items are completed, the test automatically closes and scores the candidate's responses.

2. Greeting Assessment

- Candidates are seated in a large room with five counters at the front of the stage.
- In sets of five, candidates are instructed to stand behind the counter and greet and take orders from a series of 10 "customers."
- The 10 "customers" are actually professional actors. The "customers" rotate through the five counters ordering Hamburger Heaven products.
- Each "customer" is instructed to verbally abuse the candidates while giving their order.
- An assessor is seated in front of the counter and records whether or not the candidate:
 1. Smiles.
 2. Greets the customer with the company greeting "*We are happy to have you at Hamburger Heaven. May I take your order please?*"
 3. Continues to behave courteously throughout the exchange with the "customer."

3. Order Taking Assessment

- Candidates are given a brief orientation on the HH Integrated Cash Register/Order Placing/Inventory Tracking/Performance Monitoring System (the H-HICROPIRPMS).
- After the orientation, candidates are asked to sit at a table with H-HICROPIRPMS workstation and wear headphones.
- A series of 20 orders, each with an average of five items, are provided over a taped message at a steady pace of a 15-minute period.
- Candidates are required to enter the orders in the H-HICROPIRPMS.
- Candidates are assessed on the basis of errors in the ordering of the 100 items.

4. Order Filling Assessment

- Candidates are put behind the counter again and handed a set of 20 orders, each with an average of five items.
- Candidates are required to fill all 20 orders, placing the correct artificial food item on a tray or in a bag for each order within a 15-minute period.

EXERCISE 1
Attachment 2
Validity and Reliability Review
of Hamburger Limbo Assessment Procedures

ASSESSMENT PROCEDURE:

VALIDITY ISSUES:

Assessment Procedures Positively Affecting Validity

-
-

Assessment Procedures Negatively Affecting Validity

-
-

RELIABILITY ISSUES:

Assessment Procedures Positively Affecting Reliability

-
-

Assessment Procedures Negatively Affecting Reliability

-
-

RECOMMENDATIONS FOR IMPROVING THE ASSESSMENT PROCEDURES:

Improvements to Validity

-
-

Improvements to Reliability

-
-

EXERCISE 1

Understanding Validity and Reliability

Example Solution

ASSESSMENT PROCEDURE: Greeting Assessment

VALIDITY ISSUES:

Assessment Procedures Positively Affecting Validity

- See reaction to difficult customers.
- Role play behind counter.

Assessment Procedures Negatively Affecting Validity

- Candidates see other “customers.”
- Candidates learn what to expect.

RELIABILITY ISSUES:

Assessment Procedures Positively Affecting Reliability

- Dedicated assessor.
- Some behavior well-defined.

Assessment Procedures Negatively Affecting Reliability

- “Smile” not well-defined.
- “Courteous” not well-defined.

RECOMMENDATIONS FOR IMPROVING THE ASSESSMENT PROCEDURES:

Improvements to Validity

- Insert this into a broader assessment.
- Assess candidates individually.
- Broader range of customer behavior.

Improvements to Reliability

- Define “smile” better.
- Define “courteous” better.

[This page is intentionally left blank.]

Exercise 2

Specifying Assessment Objectives

Time: 30 minutes

Purpose: Practice specifying assessment objectives

Outcome: List of assessment objectives for lifeboat task

Report: List the objectives your group specified (3 minutes)

Instructions:

A. The goal of this exercise is to specify up to six assessment objectives for a lifeboat launching assessment.

Your tools for this exercise include the following five attachments:

1. STCW & CFR Lifeboat Competencies.
2. Launching Procedure for a Gravity Davit Lifeboat.
3. Identifying Assessment Objectives for Lookout Procedures.
4. Identifying Assessment Objectives for ARPA.
5. Lifeboat Launching Assessment Objectives Worksheet.

To get started, spend a few minutes reading Attachments 1 and 2, the lifeboat launching job and task data. Then, review the examples in Attachments 3 and 4 and use them as a guide for the format of your lifeboat launching assessment objectives. Use Attachment 5, the exercise worksheet, to make preliminary notes about your assessment objectives.

B. As a small group, consider the tasks involved in lifeboat launching and specify up to 6 assessment objectives, recording your group's answers on the overhead transparency worksheet.

Remember, each objective specified should describe what the candidate needs to perform successfully to pass the lifeboat launching assessment. Each objective should include:

- An **action** (should relate to each *task* you want to observe).
- A set of preliminary **conditions** (can include any equipment you use in the assessment, the weather, time, location, and other variables – these conditions are “preliminary” because they will be refined later in the assessment development process in Step 3 – *Specify Assessment Conditions*).
- A set of preliminary **standards** (can be derived from STCW and CFR guidelines and best practices of the marine industry – the standards are “preliminary” because they will be refined later in Step 4 – *Develop Proficiency Criteria*).

Example assessment objective: *Given a simulated, relatively complex, at sea scenario with diverse traffic (condition), using ARPA calculate the required new course for own ship (action) to maintain a minimum CPA of 2 nm between own ship and other vessels (standard).*

C. Select a spokesperson to present the lifeboat launching assessment objectives specified by your group.

EXERCISE 2

Attachment 1

STCW Code & CFR Lifeboat Competencies

STCW Code Table A-VI/2-1: *Specification of the minimum standard of competence in survival craft and rescue boats other than fast rescue boats.*

STCW Competence: Take charge of a survival craft or rescue boat during and after launch.

STCW Knowledge, Understanding, and Proficiency: Various methods of devices used for launching survival craft and rescue boats; methods of launching survival craft into a rough sea.

STCW Table A-VI/2-1 Methods for Demonstrating Competence: Give correct commands for launching and boarding survival craft, clearing the ship and handling and disembarking persons from survival craft. Prepare and safely launch survival craft and clear the ship's side quickly.

46 CFR 12.10 – Lifeboatman §12.10-5 Examination and demonstration of ability.

- (a) Before an applicant is certified as a lifeboatman, he or she shall prove to the satisfaction of the Coast Guard by oral or other means of examination, and by actual demonstration, his or her knowledge of seamanship and the ability to carry out effectively all the duties that may be required of a lifeboatman. The applicant shall demonstrate that he or she:
 - (1) Has been trained in all the operations connected with the launching of lifeboats and life rafts, and in the use of oars;
 - (2) Is acquainted with the practical handling of boats; and
 - (3) Is capable of taking command of the boat's crew.
- (b) The examination, whether administered orally or by other means, must be conducted only in the English language and must consist of questions regarding:
 - (1) Lifeboats and life rafts, the names of their essential parts, and a description of the required equipment;
 - (2) The clearing away, swinging out, and lowering of lifeboats and life rafts, the handling of lifeboats under oars and sails, including questions relative to the proper handling of a boat in heavy sea; and
 - (3) The operation and functions of commonly used methods of davits.
- (c) The practical examination shall consist of a demonstration of the applicant's ability to carry out the orders incident to launching lifeboats, and the use of the boat's sail, and to row.

EXERCISE 2
Attachment 2
Launching Procedure for a Gravity Davit Lifeboat

- (1) Boat captain inspects boat and davits prior to deployment.
 - Check for potential fouls in lines, ladder.
 - Check davit trackways.
 - Remove cover / strongbacks as required.
- (2) Release the man ropes.
 - Check the tricing pendants.
- (3) Put the boat plug in.
 - Check releasing gear lever – lever down, cotter pin secured.
- (4) Rig the sea painter.
 - “Rig the sea painter.”
 - Inboard of the falls, outboard of all else on ship.
- (5) Release the gripes.
 - “Release the gripes.”
 - “Heads up.”
 - Lower to secure position.
- (6) Lower to embarkation deck.
 - “Lower away.”
 - Davits should move down trackways together.
- (7) Rig frapping lines.
 - “Pass and secure frapping lines.”
 - Secure with a strain.
- (8) Embark passengers.
 - Keep center of gravity low; hold man ropes.
- (9) Trip the tricing pendants simultaneously.
 - “Release the tricing pendants.”
 - Use trip line or hatchet; keep clear of swing of hooks as released.
- (10) Tend frapping lines.
 - “Ease the frapping lines.”
 - Slack until falls vertical.
- (11) Lower boat to water.
 - “Lower away.”
 - Fend off using boat hooks.
- (12) Release falls.
 - “Release falls.”
 - Release at the crest of the wave.
- (13) Clear vessel.
 - Pass fall blocks.
 - Secure man ropes as required to avoid fouling screw.
- (14) Release sea painter.
 - If releasing sea painter at falls, secure bitter end to fall clear of water.

EXERCISE 2

Attachment 3

Example: Specifying Assessment Objectives For Performance of Lookout Procedures

STCW Code Data

STCW Table A-II/4: *Mandatory minimum requirements for certification of ratings forming part of a navigational watch.*

STCW Function: Navigation at the support level.

STCW Competence: Keep a proper lookout by sight and hearing.

STCW Proficiency: Responsibilities of a lookout, including reporting the approximate bearing of a sound signal, light, or other object in degrees or points.

Additional Task Data

Although it is not specifically addressed in the regulations, it is important that the mariner (1) understand the lookout duties and procedures, particularly as they affect safety on the vessel; and (2) demonstrate lookout techniques. These requirements may be summarized in the following five areas:

- Knowledge of lookout duties and responsibilities.
- Knowledge of lookout-related safety procedures.
- Demonstration of lookout procedures, under various conditions.
- Demonstration of lookout equipment.
- Demonstration of related procedures, such as man overboard and lookout watch relief.

Example Objectives for Lookout Procedures Assessment

Example assessment objectives were derived using the information above as well as consultation with subject matter experts (SMEs):

Assessment Objective 1

Action: Describe lookout duties and responsibilities.

Preliminary Conditions: Examination proctor, test instrument, and any associated references.

Preliminary Standards: Mariner specifies lookout's duties as:

Sighting, identifying, and accurately reporting all objects or sounds detected.

Assessment Objective 2

Action: Identify lookout stations and safe routes onboard.

Preliminary Conditions: Examination proctor, test instrument, and any associated references.

Preliminary Standards: Mariner identifies such common lookouts, and the following relevant safe routes, of:

1. Bridge.
2. Bridge wings.
3. Bow.

Assessment Objective 3

Action: Describe and identify international distress signals.

Preliminary Conditions: Examination proctor, test instrument, and any associated references.

Preliminary Standards: Mariner identifies and describes some of the following international distress signals:

- Red star shells.
- Fog horn continually sounding.
- Flames or smoke on a vessel.
- Gun fired at intervals of 1 minute.
- SOS.
- “Mayday” by radio.
- Parachute red flare.
- Wave arms.
- Etc.

Assessment Objectives 4-6

Action: Demonstrate lookout techniques and make lookout reports.

Preliminary Conditions: Clear lookout station properly equipped; reportable objects in sight; conditions of 1) Daylight, clear visibility, 2) night, clear visibility, 3) restricted visibility (day or night).

Preliminary Standards: Mariner correctly performs the following actions:

1. Identifies six of the relevant and appropriate sightings that should be reported when detected by the lookout.
2. Reports sighted surface objects using ship's bell.
3. Reports sighted surface objects verbally using a) degrees and b) points.
4. Reports sighted sky objects verbally using points.
5. Reports audible targets verbally using points.

Assessment Objective 7

Action: Demonstrate the use of lookout equipment.

Preliminary Conditions: Clear lookout station properly; reportable objects in sight; any of the following conditions of visibility: 1) Daylight, clear visibility, 2) night, clear visibility, 3) restricted visibility (day or night).

Preliminary Standards: Mariner correctly identifies and demonstrates use of the following equipment:

1. Ship's bell.
2. Internal communications system.
3. Binoculars.
4. Bearing repeater fitted with bearing/azimuth circle, alidade, or pelorus.
5. Personal equipment.

Assessment Objective 8

Action: Demonstrate man overboard procedures.

Preliminary Conditions: Clear lookout station properly equipped; reportable objects in sight; any of the following conditions of visibility: 1) Daylight, clear visibility, 2) night, clear visibility, 3) restricted visibility (day or night); assessor simulates man overboard to starboard or port.

Preliminary Standards: Mariner correctly performs the following tasks:

1. Throwing of ring life buoy.
2. Sounding of alarm/reporting man overboard to the bridge.
3. Keeps the victim in sight at all times.

Assessment Objective 9

Action: Demonstrate lookout watch relief procedures.

Preliminary Conditions: Clear lookout station properly equipped; reportable objects in sight; any of the following conditions of visibility: 1) Daylight, clear visibility, 2) night, clear visibility, 3) restricted visibility (day or night).

Preliminary Standards: Mariner correctly answers the following questions:

1. When may a lookout leave the lookout station before being relieved?
2. What must be considered before handing over the watch to the watch relief during darkness?
3. What constitutes an adequate watch relief report?
4. What action(s) must be taken if not properly relieved?

EXERCISE 2

Attachment 4

Example: Specifying Assessment Objectives for ARPA¹

In an example ARPA assessment, McCallum, et al. (1999) divides ARPA knowledge and skill into six areas. Below are the assessment objectives for the third area, “knowledge of factors affecting performance and accuracy; and ability to operate and interpret system performance and accuracy, tracking capabilities and limitations, and processing delays.” The rest of the example ARPA assessment objectives can be found in Appendix A of the report, *Developing Performance-based Assessments of Mariner Proficiency*.

Assessment Objective	STCW Reference	Assessment Conditions	Performance Measure
Knowledge of effects of limitations of radar range and bearing on the accuracy of ARPA data	24.1 Sect. B-I/12	Exercise F Three vessels on same initial bearing, with two on collision course; and fourth vessel on a different bearing Instructions to report valid target data ASAP	3.3.1. Reported vessel data
The circumstances causing “target swap” and its effects on display data	25.4 Sect. B-I/12	Exercise C Vessels in open water passing one another and buoys	3.2.1 Identification of pairs of targets where swap is likely to occur
The effects on tracking of “lost” targets and target fading	25.3 Sect. B-I/12	Exercise A Loss of target track and sounding of “target lost” alarm	3.3.1 Identification of lost target alarm 3.3.2 Reacquisition of lost target
An appreciation of the IMO performance standards for ARPA, in particular the standards relating to accuracy	22.0 Sect. B-I/12	Written test (administered at the end of Exercise F)	3.4.1 Correct responses to written test

¹ Excerpted from Appendix A of McCallum, M. C., Forsythe, A. M., Smith, M. W. Nunnenkamp, J. M., & Sandberg, G. R. (1999). *Developing performance-based assessments of mariner proficiency*. (Report Number R&DC-202-99). Groton, CT: USCG R&D Center.

EXERCISE 2
Attachment 5
Lifeboat Launching Assessment Objectives Worksheet

ASSESSMENT OBJECTIVE 1

Action:

Preliminary Condition(s):

Preliminary Standard(s):

ASSESSMENT OBJECTIVE 2

Action:

Preliminary Condition(s):

Preliminary Standard(s):

ASSESSMENT OBJECTIVE 3

Action:

Preliminary Conditions:

Preliminary Standards:

ASSESSMENT OBJECTIVE 4

Action:

Preliminary Condition(s):

Preliminary Standard(s):

ASSESSMENT OBJECTIVE 5

Action:

Preliminary Condition(s):

Preliminary Standard(s):

ASSESSMENT OBJECTIVE 6

Action:

Preliminary Conditions:

Preliminary Standards:

EXERCISE 2

Specifying Assessment Objectives

Example Solution

Assessment Objective 1

Action: Person in charge carries out proper inspections.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities. The following conditions can be varied:

1. The sea painter is fouled, missing or not made fast properly.
2. One or both tricing pendants are not secured or are secured improperly.
3. The man ropes are fouled.
4. The drain plug cap is missing or damaged.
5. Rudder, tiller or other equipment is missing or damaged.
6. The frapping lines are fouled or missing.

Preliminary standards: The person in charge inspects the lifeboat, falls and davit. Using proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Insures the lifeboat releasing gear is attached properly to the falls.
2. Checks to make sure the releasing gear lever is in the proper position (lever down), with the pin in place.
3. Insures the tricing pendent is in place and secured properly.
4. Insures that the sea painter is clear, attached to the thwart properly and ready to lead out.
5. Checks the drain plug cap is in good condition and ready for proper placement.
6. Checks general condition and arrangement of boat equipment.
7. Determines that the man ropes are not fouled.
8. Insures the davit tracks are clear.
9. Makes sure the frapping lines are in place and ready to be passed.
10. Insures that the hand crank is in the stowed position.

Assessment Objective 2

Action: The person in charge prepares the lifeboat for launching.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities. The following conditions can be varied:

Sea painter is secured improperly to the thwart or not secured at all.

One or both tricing pendants are secured to the falls improperly or not at all.

Preliminary standards: The person in charge prepares the boat for lowering. Using the proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Puts the drain plug cap on.
2. Leads out the sea painter, forward, inboard of the falls outboard of everything else on the vessel. Secures the painter to the thwart if necessary.
3. Lowers man ropes.
4. Makes tricing pendants fast if necessary.
5. Releases the gripes insuring that all personnel are clear and out of the lifeboat.
6. Removes gripes from the lifeboat.
7. Insures that the locking bars are clear of the davit tracks.

Assessment Objective 3

Action: The person in charge lowers the lifeboat to the embarkation deck.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities.

Preliminary standards: The person in charge lowers the boat to the embarkation deck. Using the proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Clears all personnel from the area around and under the lifeboat.
2. Insures no one has his/her hands on the davit tracks.
3. Raises the brake handle lowering the boat slowly.
4. Lowers the boat to the embarkation deck. The tricing lines bringing the boat to the side of the ship.
5. Insures that the lifeboat does not slam into the side of the ship due to lowering it too fast or too far.

Assessment Objective 4

Action: The person in charge embarks the crew and passengers.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities.

Preliminary standards: The person in charge lowers the boat to the embarkation deck. Using the proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Passes and secures the frapping lines properly. They are secured under a strain with no slack. They must be secured so that they can be slackened without jamming.
2. Insures that all crew and passengers are wearing lifejackets properly.
3. Boards the crew and passengers in lifeboat.
4. Insures that all personnel are seated and holding on to a man rope.
5. Releases the tricing pendants using the tripping lines insuring that all personnel are clear of the hook and pendant as it swings clear.
6. Slacks the frapping lines easing the lifeboat outboard until the falls are vertical.

Assessment Objective 5

Action: The person in charge lowers the lifeboat to the water.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities.

Preliminary standards: The person in charge lowers the boat to the water. Using the proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Raises the brake handle lowering the lifeboat to the water's edge.
2. Insures no crew or passengers are fouled in man ropes.
3. Fends the lifeboat off from the side of the ship if necessary.

Assessment Objective 6

Action: The person in charge of the boat clears the lifeboat away from the ship.

Conditions: Lifeboat is available for assessment purposes. The boat is clear and the assessor can observe activities.

Preliminary standards: The person in charge of the boat clears the boat away from the ship. Using the proper commands and nautical terminology he/she demonstrates consideration and supervises the proper performance of the following steps:

1. Releases the falls taking care that no personnel are knocked overboard or injured by the blocks or falls.
2. Fends the boat away from the ship if necessary.
3. Releases the sea painter.

EXERCISE 3

Determining Assessment Methods

Time: 15 minutes

Purpose: Practice determining appropriate assessment methods

Outcome: Appropriate assessment methods for six lifeboat assessment objectives

Report: Explain which assessment method(s) you selected for each objective and why
(2 minutes)

Instructions:

A. The goal of this exercise is to select the most appropriate assessment method for each of your lifeboat launching assessment objectives. Remember that the basic assessment methods are:

- Written or oral questions.
- Simulation using mock equipment (e.g., a personal computer interface in lieu of an actual radar screen.).
- Simulation in a laboratory using actual equipment.
- Shipboard assessments.

For a comparison of these assessment methods, see Attachment 1, *Pros and Cons of Basic Assessment Methods*. For an example of the considerations involved in selecting assessment methods, refer to Attachment 2, *Determining Assessment Methods for Lookout Procedures*. Use Attachment 3, *Lifeboat Launching Assessment Methods Worksheet*, to make notes as you consider which assessment method to use for each objective.

B. To determine the appropriate assessment method for each lifeboat launching objective, discuss the following questions in your small group:

- What *performance* must be assessed?
 - Review the assessment objectives specified in Exercise 2.
 - Consider how the task is initiated.
 - Consider what the result of task performance is.
 - Consider the process of performing the task.
- Review *realism* (validity) requirements.
 - Environment/setting.
 - Controls.
 - Displays.
 - Processing characteristics.
- Review *control* (reliability) requirements.
 - Key skill and knowledge requirements.
 - Variability of task conditions.
 - Comparability of assessment conditions.

- What assessment methods are *feasible*?
 - Can the performance be measured via written assessment?
 - Can a simulator or laboratory replicate the conditions closely enough to cue the behavior?
 - Can the performance be easily and safely elicited onboard ship?
 - Which method is the easiest, cheapest, safest, and most legally defensible?

NOTE: If you select shipboard assessment as the method for any objective, specify whether the assessment should be underway or in port.

C. Record your group's answers on an overhead transparency worksheet, and select a spokesperson to present your assessment methods and rationale to the larger group.

EXERCISE 3
Attachment 1
Pros and Cons of Basic Assessment Methods

Assessment Method	Pros	Cons
Written or oral	<ul style="list-style-type: none"> - Easy to create - Easy to standardize - Easy to test many at once - Good for measuring knowledge 	<ul style="list-style-type: none"> - May have poor similarity to work environment - Candidate needs good verbal skills
Simulation using mock equipment	<ul style="list-style-type: none"> - High control - Safe 	<ul style="list-style-type: none"> - May be expensive - May have poor similarity to work environment - Usually need one assessor per candidate
Simulation in a laboratory using actual shipboard equipment	<ul style="list-style-type: none"> - High control - Safe - May have high similarity to work environment 	<ul style="list-style-type: none"> - May be expensive - Usually need one assessor per candidate
Shipboard	<ul style="list-style-type: none"> - May be inexpensive - Uses actual work setting 	<ul style="list-style-type: none"> - Usually need one assessor per candidate - May be difficult to fit into operational schedule - More difficult to standardize and score - Task may be infrequent or dangerous

EXERCISE 3
Attachment 2
Example: Determining Assessment Methods
for Lookout Procedures

Additional Considerations in Assessment Method Selection:

1. Assessment Requirements.
 - Knowledge of lookout duties and procedures.
 - Correct use and operation of lookout techniques, reporting, and equipment.
2. Assessment Constraints.
 - Must not interfere with vessel safety.
 - Equipment must be available and operational.
 - Scheduling to allow for conditions of clear visibility in daylight and at night, plus restricted visibility during day or night.

Selection of Assessment Method:

Written or oral test questions are needed to assess knowledge of lookout duties and procedures, covering Assessment Objectives 1 to 3.

Correct use and operation of lookout techniques, reporting, and equipment requires shipboard or simulator assessment. Shipboard assessment offers the highest degree of validity, making a very good choice of assessment method provided that the constraints discussed above are met.

EXERCISE 3
Attachment 3
Lifeboat Launching Assessment Methods Worksheet

Assessment Objective	Assessment Method
1. Carry out proper inspections	
2. Prepare lifeboat for launching	
3. Lower lifeboat to the embarkation deck	
4. Embark crew and passengers	
5. Lower lifeboat to the water	
6. Clear lifeboat away from the ship	

EXERCISE 3

Determining Assessment Methods

Example Solution

Considerations in assessment method selection

1. Is written, knowledge-based assessment appropriate? Is it sufficient?
2. Availability of lifeboat and davit.
3. Operational safety.
4. Possibility of damaging a vessel's lifesaving equipment.
5. Ability to vary conditions on equipment to be used.
6. Alternate methods available, such as lifeboat models.

Discussion of considerations

1. A written or oral assessment:
 - a) Would be useful in determining a candidate's knowledge of lifeboat launching procedures, terminology, and regulations.
 - b) Is not a measure of a candidate's ability to either carry out or perform the tasks needed to be done in launching the boat.
 - c) Has poor face validity.
 - d) Offers a high degree of reliability.
2. Availability of lifeboats is high. All vessels are equipped with them. In addition, most training facilities have available for training a lifeboat and davit either installed on a pier or aboard a training vessel.
3. Operational safety must not be compromised and would always be a primary concern. Assessors must be extremely careful to guard against candidates falling overboard or being injured by equipment. For this reason, not all objectives can be carried out while the vessel is underway. It may also be necessary for the assessor to step in and stop or correct a procedure before an accident occurs.
4. Damaging the lifesaving equipment aboard a vessel is a concern. Damaged equipment could put the ship's crew at risk or cause delays in port while equipment is repaired or replaced. This would not be as critical if the assessment were carried out at a training institution where equipment is dedicated for training, not lifesaving.
5. The ability to vary conditions of the assessment would be the same for lifeboats aboard an operating vessel or lifeboats at a training institution. There would be a natural reluctance for a vessel's crew to alter conditions in a lifeboat.
6. Model lifeboats can be used to assess lifeboat competency. However, they have poor face validity and most mariners consider them a poor substitute for a real lifeboat.

Example assessment method

1. Lifeboats aboard an operating vessel or at a training institution could be used.
2. If a lifeboat aboard a vessel was used only objectives 1 - 3 could be assessed at sea while the vessel was underway. Objectives 4 - 6 would have to be assessed when the vessel was in port. At a training institution, all objectives could be assessed at one time.

EXERCISE 4

Specifying Assessment Conditions

Time: 20 minutes

Purpose: Practice specifying assessment conditions

Outcome: Assessment conditions for one lifeboat assessment objective

Report: List the conditions your group specified (2 minutes)

Instructions:

- A. The goal of this exercise is to specify assessment conditions for one lifeboat launching assessment objective. Each group is assigned a different objective; see your group's overhead transparency worksheet for the objective that you have been assigned.
- B. To get started, refer back to the preliminary conditions that you specified for this objective in Exercise 2, and the assessment method that you specified for this objective in Exercise 3. Consider these as you specify the conditions for this exercise.

Attachments 1 and 2 provide you with some examples of assessment conditions for the lookout procedures assessment and ARPA assessment. Use these examples as a guide for the format of the assessment conditions you specify for your lifeboat launching assessment.

Remember that your conditions should include:

- Candidate orientation.
- Equipment, apparatus, and tools.
- Initial equipment settings or scenarios.
- Written or oral questions.

- C. Use Attachment 3, *Lifeboat Launching Assessment Conditions Worksheet*, to do a preliminary outline of the assessment conditions for your assessment objective. Record your final answers on your overhead transparency worksheet.
- D. Select a spokesperson to tell the larger group the assessment conditions your group specified and your rationale.

EXERCISE 4
Attachment 1
Example: Specifying Assessment Conditions for
Lookout Procedures

Discussion of requirements and constraints for Assessment Objective 4

1. Assume shipboard assessment and/or ship bridge simulator assessment, oral or written test questions.
2. Review the preliminary conditions under Assessment Objective 4.
3. Ensure that equipment is available and operational.
4. Ensure safe operation of vessel and proper safety procedures.

Assessment Objective Measured:

Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.

Candidate Orientation:

- Assessor briefs the candidate on assessment methods, conditions, and standards.

Equipment, Apparatus, and Tools:

- The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear, and the assessor must be able to observe activities.

Initial Equipment Settings or Scenarios:

- The assessment should be conducted in clear visibility during daylight. The assessor should ensure that there are reportable objects in sight.

Written or Oral Questions:

- Identify six of the sightings that should be reported when detected by the lookout.

EXERCISE 4

Attachment 2

Example: Specifying Assessment Conditions for ARPA

The following exercise is one of seven exercises comprising the example ARPA assessment in *Developing Performance-based Assessments of Mariner Proficiency* (McCallum et al., 1999). The other exercises, candidate worksheets, and assessor instructions can be found in appendices B, C, and D of that report.

Assessment Objective Measured:

Understanding of when to use ground- or sea-stabilized modes, and when to use north-up, course-up, and head-up presentations.

Exercise E

Candidate Orientation

- Assessment is conducted using a full-scale functional ARPA in a laboratory setting.
- Narrow channel navigation.
- Cross current and/or wind requiring “crabbing” of ship down the channel; crabbing is facilitated by ground stabilized presentation method.
- Own ship is outbound.
- One threat vessel is inbound.

Equipment, Apparatus, and Tools

1. Full-scale ARPA Simulator.
2. ARPA Set-Up Instructions.
 - a. Initialize your ARPA unit with a ground-stabilized presentation method.
 - b. Set autodrift (groundlock) to target bearing 172° at 4 nm.
 - c. Avoid collisions or groundings.
3. Target Information Forms.
 - a. Record vessel data for any inbound target(s), and include the time you recorded the data for each target:

Initial Bearing	Target	Course	Speed	CPA	TCPA	Time
	A					
	B					

EXERCISE 4

Attachment 2 (cont.)

Initial Equipment Settings or Scenarios:

1. Vessel data at 1100:00 (approximate).

Target	Bearing	Range	Course	Speed	CPA	TCPA
Own ship	NA	NA	180	15	NA	NA
<i>A</i>	167	7.0	347	11	0.2	17.5

2. Detailed scenario description.

Time	Phase	Event	Objective Number	Performance Measure	Correct Response
1100:00	Set-up	Operator is given a chartlet	NA	NA	NA
1100:00	Set-up	Operator is instructed to use ground-stabilized presentation method	1.1	Measured in Exercise A	See Exercise A
1101:00	Simulation	Operator instructed to set autodrift to target bearing 172° at 4 nm	1.3	Measured in Exercise A	See Exercise A
1101:00	Simulation	Operator navigates own ship through channel avoiding buoys, land, and other target	1.6	1.6.1 Maintenance of ship position and course	Bearing of 180° maintained with no groundings
1102:00	Simulation	Operator instructed to record vessel data for any inbound target(s)	2.6	Measured in Exercises A, C, D	See Exercises A, C, D
1113:00	Simulation	After passing under bridge, operator reports lights that would be seen on Target <i>A</i> from 1113:00 to 1115:00	1.6	1.6.2 Determination of aspect of other vessel	Green lights

Written or oral question (one):

Your vessel is under your control: What color lights should you see on the inbound target when you emerge from under the Verrazano Bridge, at about 1113:00?

EXERCISE 4
Attachment 3
Lifeboat Launching Assessment Conditions Worksheet

Assessment Objective:

Assessment Method:

Candidate Orientation:

Equipment, Apparatus, and Tools:

Initial Equipment Settings or Scenarios:

Written or Oral Questions:

EXERCISE 4

Specifying Assessment Conditions

Example Solution

Discussion of assessment requirements and constraints

1. Assume shipboard assessment of Assessment Objective 1, “person in charge carries out proper inspections.”
2. Review the conditions under Objective 1 and determine if any of the conditions should be modified to assess the candidate’s performance.
3. Determine the appropriate time to carry out the assessment taking into account, normal shipboard routine, weather / sea conditions, and status of the equipment.
4. Review the working space in and around the lifeboat to determine the position of the assessor. Assessor’s position should allow adequate observation of the individual’s performance.
5. Review steps necessary to ensure safety.
6. Ensure the person being assessed has sufficient knowledge, training and experience to complete Objective 1.

Example assessment conditions

Assessment Objective

Lifeboat launching pre-start checks.

Assessment method

Shipboard.

Candidate Orientation

The assessor should brief the candidate on what objective will be assessed.

The candidate will be instructed that he/she may order other crewmembers to carry out inspections. He/she must use proper commands and supervise the crewmembers closely, ensuring the inspection is carried out properly.

Equipment, Apparatus, and Tools

Fully functional lifeboat and launching equipment

Initial Equipment Settings or Scenarios

The assessment will be conducted during the weekly abandon ship drill under weather and sea conditions that will allow assessment to be carried out safely.

The assessment will start with the lifeboat secured in the stowed position.

Written or Oral Questions

None provided.

EXERCISE 5

Developing Performance Measures

Time: 45 minutes
Purpose: Practice developing performance measures
Outcome: List of multiple performance measures for selected lifeboat assessment objectives
Report: List the measures that your group selected (5 minutes)

Instructions:

A. The goal of this exercise is to develop performance measures for up to 6 lifeboat launching assessment objectives.

Your tools for this exercise are:

- Your group's responses to Exercises 2-4 (assessment objectives, method, and conditions).
- Attachment 1, *Developing Performance Measures for Rules of the Road*.
- Attachment 2, *Developing Performance Measures for Lookout Procedures*.
- Attachment 3, *Lifeboat Launching Performance Measures Worksheet*.

B. To get started:

- Review your outputs from Exercises 2-4 (assessment objectives, method, and conditions).
- Consider the basic performance requirements of lifeboat launching.
- Define specific performance measures for each lifeboat launching assessment objective.
- Remember that performance *measures* are procedures for observing and recording performance. They describe either observable actions, or the outcomes of those actions; they do *not* describe how well the candidate has to perform the action(s).
- Try to include both process and product measures.
- Please do NOT specify performance *standards*; they will be the focus of the next exercise.

For examples of performance measures for other types of assessments, review Attachments 1 and 2, which describe Rules of the Road and Lookout Procedures performance measures.

Record your group's answers on your overhead transparency worksheet.

C. Select a spokesperson to tell the group about the performance measures you developed and your rationale.

EXERCISE 5

Attachment 1

Developing Performance Measures for Rules of the Road²

Introduction

The steps involved in developing performance measures and standards are depicted in Figure 1 below. Since Exercise 5 is concerned only with performance *measures*, only Steps 1 and 2 are discussed in this document. Steps 3-6, which concern performance *standards*, are discussed in Exercise 6, Attachment 1.

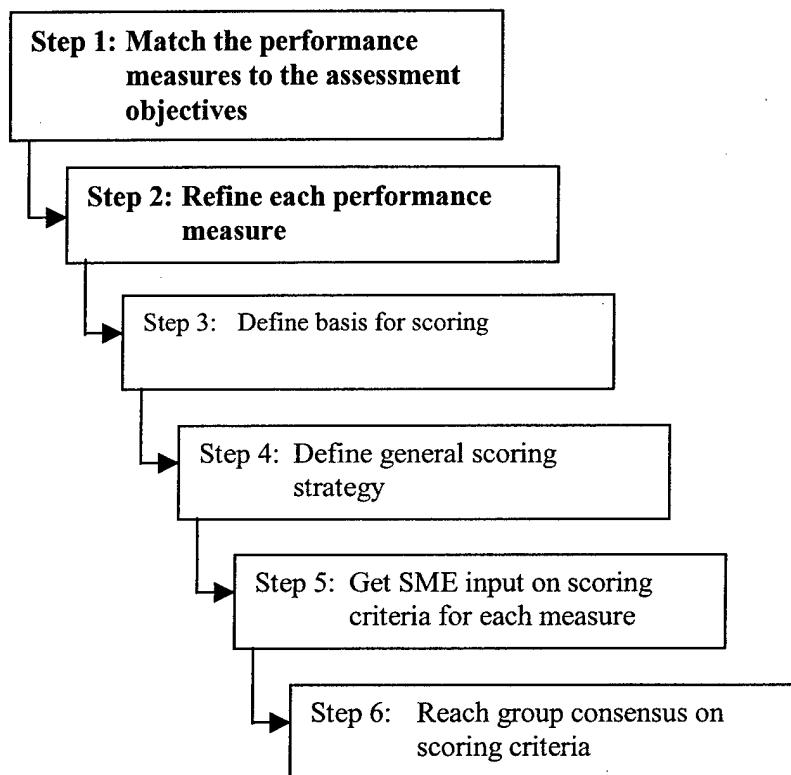


Figure 1. Summary of steps in the development of performance measures and scoring criteria.

Steps 1 and 2 are described below using an example in which a simulator was used to assess knowledge of, and ability to apply, Rules of the Road (ROR).

Steps in the Performance Measure Development Process

Step 1: Match the performance measures to the assessment objectives. The assessment objectives were considered, and three basic requirements of navigation law during watch were

² From Smith, M.W., Sandberg, G. R., McCallum, M.C., Stewart, R., Hard, C., Meurn, R., and Baker, D. (1996). *An interactive test of mariner competence*. U.S. Coast Guard Report No. CG-D-04-97.

defined: (1) maintain a good lookout and determine if risk of collision exists; (2) take appropriate action or maneuver to avoid collision; and (3) determine if own ship's action or maneuver was adequate to avoid collision, and ensure that the action or maneuver does not put own ship in a close quarters situation with other vessels.

Step 2: Refine each performance measure. Next, the general performance requirements defined in Step 1 were extrapolated into a series of specific bridge operation measures. Proposed bridge operation measures addressed visual search, binocular viewing, visual bearing, radar viewing, use of sound signals, closest point of approach (CPA), vessel speed, maneuver direction, and action or maneuver to avoid collision. Table 1 summarizes the bridge performance measures developed in this example.

Table 1. Summary of bridge performance measures

Performance Measure	Description
Visual Search	Score based on expert mariners' expected time spent visually searching each of four quadrants of view during the scenario observation period.
Binocular Viewing	Score based on expert mariners' expected frequency of viewing each vessel through the binoculars during the scenario observation period.
Visual Bearing	Score based on expert mariners' expected frequency of visual bearings of each vessel to be taken during the scenario observation period.
Radar Viewing	Score based on expert mariners' expected frequency and total duration of radar viewings during the scenario observation period.
Maneuver Signal	Proportion of times a correct signal was sounded within 30 seconds of a maneuver.
CPA	Score based on expert mariners' expected minimum closest point of approach to other vessels throughout each test scenario.
Radar Maneuver	Score based on expert mariners' expected frequency and total duration of radar viewings during the first six minutes after the first own ship maneuver.
Fog Signal	Score based on expert mariners' expected time of first sounding of the restricted visibility sound signal during the fog scenario.
Fog Speed	Score based on expert mariners' expected time and level of action to reduce speed following radar failure during the fog scenario.
Action or Maneuver	Action or maneuver, and projected CPA with threat vessel following completion of maneuver (<i>scores not obtained for analysis</i>).

EXERCISE 5
Attachment 2
Developing Performance Measures
for Lookout Procedures

Discussion of requirements and constraints for Assessment Objective 4

1. Assume shipboard assessment and/or ship bridge simulator assessment, oral or written test questions.
2. Review the preliminary standards under Assessment Objective 4 and define performance measures for each.

Assessment Objective Measured

Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.

Preliminary Standards: Mariner demonstrates proper consideration and correct performance of the following actions:

1. Identifies six of the relevant and appropriate sightings that should be reported when detected by the lookout.
2. Reports sighted surface objects using ship's bell.
3. Reports sighted surface objects verbally using a) degrees and b) points.
4. Reports sighted sky objects verbally using points.
5. Reports audible targets verbally using points.

Example performance measures for Assessment Objective 4

1. Candidate answers question *Identify six of the sightings that should be reported when detected by the lookout.*
2. Candidate reports sighted surface objects using the ship's bell.
3. Candidate reports sighted surface objects verbally using degrees.
4. Candidate reports sighted surface objects verbally using points.
5. Candidate reports sighted sky objects verbally using points.
6. Candidate reports audible targets verbally using points.

EXERCISE 5
Attachment 3
Lifeboat Launching Assessment
Performance Measures Worksheet

ASSESSMENT OBJECTIVE:

PERFORMANCE MEASURE(S):

EXERCISE 5

Developing Performance Measures

Example Solution

The following performance measures could be used for Assessment Objective 1, “person in charge carries out proper inspections”:

1. Candidate inspects the releasing gear.
2. Candidate checks releasing gear lever.
3. Candidate inspects tricing pendants.
4. Candidate inspects sea painter.
5. Candidate checks drain plug.
6. Candidate inspects the general condition and arrangement of lifeboat equipment.
7. Candidate inspects man ropes.
8. Candidate inspects davit tracks.
9. Candidate inspects frapping lines.
10. Candidate locates hand crank.
11. Candidate communicates with other crewmembers clearly using proper terminology.

NOTE: The assessor observes the candidate’s performance of the above tasks. After performing each task, the candidate reports to the assessor on each measure. If Assessment Objective 2 is also being assessed, then the candidate will be expected to correct any discrepancies found during the assessment of Objective 1.

[This page is intentionally left blank.]

EXERCISE 6

Developing Performance Standards

Time: 45 minutes

Purpose: Practice developing and gaining agreement on performance standards

Outcome: Agreed upon standards for one lifeboat launching assessment objective and its associated performance measures

Report: Tell group what standards you agreed upon and why (10 minutes)

Instructions:

A. The goal of this exercise is to develop performance standards for up to 3 lifeboat launching assessment objectives. Pretend you are a group of subject matter experts convening to discuss the performance standards and scoring criteria for a lifeboat launching assessment.

Your tools for this exercise are:

- Your group's responses to Exercise 5 (lifeboat launching performance measures).
- Attachment 1, *Developing Performance Standards for Rules of the Road*.
- Attachment 2, *Developing Performance Standards for Lookout Procedures*.
- Attachment 3, *Lifeboat Launching Assessment Performance Standards Worksheet*.

B. To get started, consider the performance measures you developed for each assessment objective in Exercise 5. For each measure, specify:

- The standard scoring strategy - remember that the strategy can be either pass/fail or graded (e.g., expert, qualified, not qualified).
- Who you would include in the consensus-gathering meeting.
- The specifically defined performance standards.
- Why you chose these standards.
- How you would combine measures for a single objective (if applicable).

C. For examples of performance standards for other types of assessments, review Attachments 1 and 2.

Record your group's answers on the overhead transparency worksheet.

D. Select a spokesperson to tell the larger group the performance standards you chose and why.

EXERCISE 6

Attachment 1

Developing Performance Standards for Rules of the Road³

Introduction

The steps involved in developing performance measures and standards are depicted in Figure 1 below. Since this exercise is concerned with performance *standards*, only Steps 3-6 are discussed in this document. Steps 1 and 2 are discussed in Exercise 5, Attachment 1.

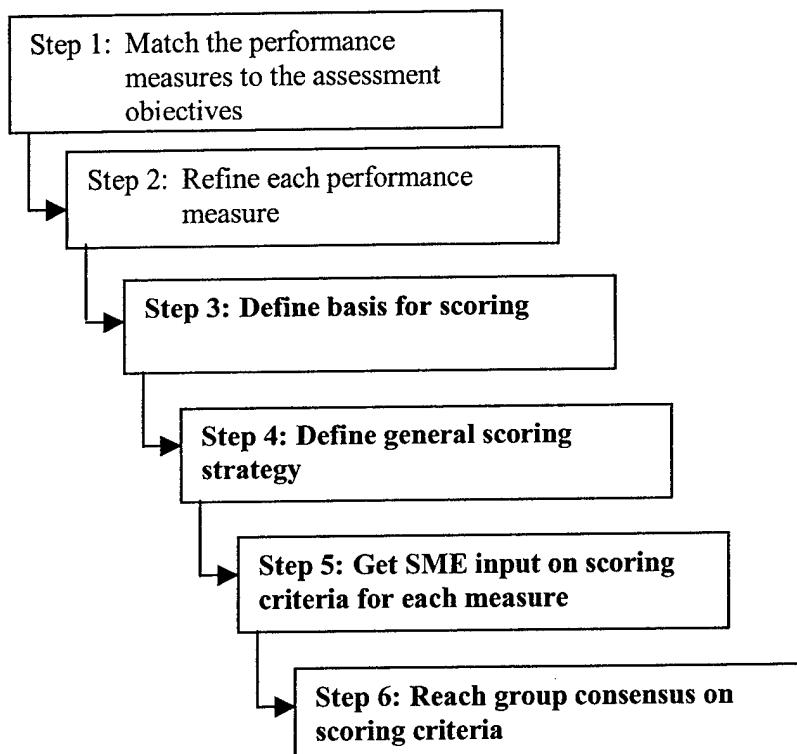


Figure 1. Summary of steps in the development of performance measures and scoring criteria.

Steps 3-6 are described below using an example in which a simulator was used to assess knowledge of, and ability to apply, Rules of the Road (ROR).

³ From Smith, M.W., Sandberg, G. R., McCallum, M.C., Stewart, R., Hard, C., Meurn, R., and Baker, D. (1996). *An interactive test of mariner competence*. U.S. Coast Guard Report No. CG-D-04-97.

Steps 3-6 in the Performance Standard Development Process

Step 3: Define basis for scoring. Given the specific performance measures, it was necessary to define the basis for scoring. In discussions among the expert mariners, it was determined that one of two general approaches toward scoring would be applied to each bridge operation measure. In most cases, a Proficiency Rating was applied. In selected cases, a Proficiency Qualification criterion was applied, and performance was scored as either “competent” or “not competent.” Levels of proficiency and competency were defined as follows:

Proficiency Rating is defined with reference to both navigation law and professional standards. Considering both, it is the consistency of performance with legally mandated actions, as defined by navigation law; and with the indicated level of prudent seamanship (expert, qualified, unqualified) in the operational application of navigation law. These three proficiency ratings are:

- **Expert:** Performance is fully consistent with all legal mandates and meets the highest professional standards of prudent seamanship in the operational application of navigation law.
- **Qualified:** Performance is fully consistent with all legal mandates and meets acceptable professional requirements of prudent seamanship in the operational application of navigational law.
- **Unqualified:** Does not meet one or both of the legally mandated actions and/or acceptable professional requirements of prudent seamanship in the operational application of navigation law.

Proficiency Qualification is defined with reference to navigation law only. It is the consistency of performance with legally mandated actions, as defined by navigation law. The two levels of competency are:

- **Qualified:** Performance is fully consistent with legally mandated actions.
- **Unqualified:** Performance is inconsistent with legally mandated actions.

Step 4: Define general scoring strategy. The next step in the development of performance standards called for the consideration of the general scoring strategy to be employed with each measure. Each performance measure was considered in turn, and the basic parameters to be considered were defined. For example, in the case of Visual Search, it was determined that the Proficiency Rating approach would be applied. Additionally, it was determined that one set of visual search measures would involve the percentage of a test participant’s total visual search time in each of the four visual quadrants during the first six minutes of a scenario. Given this definition, it was then recognized that ranges of percentages would be required to define the expert, qualified watchstander, and unqualified levels of performance.

Step 5: Get subject matter expert (SME) input on scoring criteria for each measure. For each bridge operation measure, a modified Delphi technique was employed to define performance standards corresponding to specific Proficiency Rating or Qualification. Basically, the Delphi technique involves an iterative process of review, independent input, and group discussion that continues until a group consensus is reached. During this process, expert mariners reviewed the operational situation for a given test scenario then individually recommended performance standards.

Step 6: Reach group consensus on scoring criteria. The set of recommended performance standards were then reviewed by the group of expert mariners until a consensus standard was obtained for the specific measure and scenario. Table 1 presents the results of this process for the example measure of Visual Search during the first six minutes of a bridge simulator scenario. This table provides the specific ranges of percentages of total Visual Search time that the team of expert mariners judged to correspond to each Proficiency Rating for the conditions in this scenario.

Table 1. Example of a performance standard for the measure of visual search

Percentage of Total Visual Search Time in Each Direction During First Six Minutes				Performance Rating
<i>Forward</i>	<i>Starboard</i>	<i>Aft</i>	<i>Port</i>	
35-50	30-45	5-15	5-15	Expert
25-34, 51-80	15-29, 46-80	16-35	16-35	Qualified
Neither Expert nor Qualified				Unqualified

Steps 5 and 6 of this process were repeated for each bridge operation measure in each scenario, resulting in quantitative scoring criteria analogous to those in table 1 for each measure in each scenario.

EXERCISE 6

Attachment 2

Developing Performance Standards for Lookout Procedures

Performance standard requirements and constraints:

1. Assume shipboard assessment and/or ship bridge simulator assessment, oral or written test questions.
2. Review the measures under Assessment Objective 4 and define performance standards for each.

Example performance standards for Assessment Objective 4: *Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.*

OBJECTIVE	MEASURE	STANDARD
4.1 List the sightings that should be reported when detected.	Answers question: Identify six of the sightings that should be reported when detected by the lookout.	Correct response includes 6 of the following sightings: Distress signals; persons in distress; vessels and/or aircraft in distress; derelicts, wreckage, floating, or partially submerged debris; pollution incident; vessel traffic and/or aircraft; aids to navigation (nav. buoys and lights); danger to the vessel or hazards to navigation; reduction in visibility due to fog, mist, falling snow, heavy rainstorms, sandstorms, or any other similar cause; change in weather; hearing other vessels or aids to navigation; ice; unusual sightings or any unreported change in the field of view or sector; sightings of marine life in compliance with the Endangered Species Act / Marine Mammal Protection Act.
4.2 Report sighted objects using the ship's bell.	Reports sighted objects using the ship's bell.	Reports at least 3 surface objects using ship's bell. Improper reporting constitutes failure. Failure to detect visible objects within a specified sector of view constitutes failure.

EXERCISE 6
Attachment 2 (cont.)

OBJECTIVE	MEASURE	STANDARD
4.3 Report sighted objects verbally using degrees.	Reports sighted objects verbally using degrees.	<p>Verbally reports at least 3 surface objects. Reports must be within $22\frac{1}{2}^{\circ}$ of the actual bearing of detected targets.</p> <p>Improper reporting constitutes failure. Failure to detect a visible object within a specified sector of view constitutes failure.</p>
4.4 Report sighted objects verbally using points.	Reports sighted objects verbally using points.	<p>Verbally reports at least 3 surface objects. Reports should indicate:</p> <ul style="list-style-type: none"> • What (type of objects) • Where (bearings, relative or true) • How far off (hull-down, on the horizon, hull-up, close aboard). <p>Reports must be within ± 2 points of the actual bearing of the detected targets.</p> <p>Improper reporting constitutes failure. Failure to detect a visible object within a specified sector of view constitutes failure.</p>
4.5 Report sky objects verbally using points.	Reports sighted objects verbally using points.	<p>Verbally reports at least 3 sky objects using points. Reports must be within ± 2 points of the actual bearing of detected targets.</p> <p>Improper reporting constitutes failure. Failure to detect a visible object within a specified sector of view constitutes failure.</p>

EXERCISE 6

Attachment 2 (cont.)

4.6 Report audible targets verbally using points.	Reports audible targets verbally using points.	<p>Verbally reports at least 3 audible targets. Reports should indicate:</p> <ul style="list-style-type: none">• What (type of objects)• Where (bearings, relative or true)• How far off (hull-down, on the horizon, hull-up, close aboard). <p>Reports must be within \pm 2 points of the actual bearing of the detected targets.</p> <p>Improper reporting constitutes failure. Failure to detect a visible object within a specified sector of view constitutes failure.</p>
FINAL SCORE: <input type="checkbox"/> Pass <input type="checkbox"/> Fail	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

EXERCISE 6
Attachment 4
Lifeboat Launching Assessment
Performance Standards Worksheet

ASSESSMENT OBJECTIVE:

PERFORMANCE MEASURE(S):

STANDARD SCORING STRATEGY (*pass/fail or graded*):

WHO WOULD BE INCLUDED IN THE CONSENSUS GATHERING MEETING:

PERFORMANCE STANDARD(S):

WHY YOU CHOSE THESE STANDARDS:

HOW YOU WOULD COMBINE MEASURES (*if applicable*):

ASSESSMENT OBJECTIVE:

PERFORMANCE MEASURE(S):

STANDARD SCORING STRATEGY (*pass/fail or graded*):

WHO WOULD BE INCLUDED IN THE CONSENSUS GATHERING MEETING:

PERFORMANCE STANDARD(S):

WHY YOU CHOSE THESE STANDARDS:

HOW YOU WOULD COMBINE MEASURES (*if applicable*):

ASSESSMENT OBJECTIVE:

PERFORMANCE MEASURE(S):

STANDARD SCORING STRATEGY (*pass/fail or graded*):

WHO WOULD BE INCLUDED IN THE CONSENSUS GATHERING MEETING:

PERFORMANCE STANDARD(S):

WHY YOU CHOSE THESE STANDARDS:

HOW YOU WOULD COMBINE MEASURES (*if applicable*):

EXERCISE 6

Developing Performance Standards

Example Solution

Performance standard requirements and constraints:

- Assume shipboard assessment of Assessment Objective 1 “person in charge carries out proper inspections.”
- Review the 11 performance measures and preliminary standards for Assessment Objective 1 and develop a set of performance standards for each performance measure.
- Determine the basis for scoring criteria. Will a graded or pass/fail strategy be used for scoring?
- Determine if assessment of Objective 1 will use individual or combined criteria. Will the failure to carry out one or more of the performance measures properly result in an automatic failure for the objective? (Note: In an overall lifeboat assessment, it must be determined if the failure of any of the objectives would result in the failure of the lifeboat exam).

Example performance standards for Assessment Objective 1:

1. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, releasing gear.
Standard: Candidate correctly reports the condition of the releasing gear.
2. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, releasing gear lever.
Standard: Candidate correctly reports the condition of the releasing gear lever.
3. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, tricing pendants.
Standard: Candidate correctly reports the condition of the tricing pendants.
4. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, sea painter.
Standard: Candidate correctly reports the condition of the sea painter.
5. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, drain plug.
Standard: Candidate correctly reports the condition of the drain plug.
6. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, the general condition and arrangement of lifeboat equipment.
Standard: Candidate correctly reports the condition of the lifeboat equipment.

7. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, man ropes.

Standard: Candidate correctly reports the condition of the man ropes.

8. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, davit tracks.

Standard: Candidate correctly reports the condition of the davit tracks.

9. **Measure:** Candidate either properly inspects, or orders and supervises the inspection of, frapping lines.

Standard: Candidate correctly reports condition of the frapping lines.

10. **Measure:** Candidate locates the hand crank.

Standard: Candidate correctly reports its proper location.

11. **Measure:** Candidate gives orders as required.

Standard: Candidate gives clear, distinct orders using proper terminology without hesitation.

NOTES:

1. Assumes graded level standard strategy is used. Suggested levels are:

- a) **Expert** – Measure is accomplished correctly and efficiently, without hesitation, using proper terminology.
- b) **Qualified** – Measure is accomplished correctly with some thought and hesitation. Minor mistakes in terminology are made which would not result in failure to launch the lifeboat.
- c) **Unqualified** – Measure is not accomplished, or accomplished incorrectly. Terminology used is incorrect and might result in misunderstandings.

2. Failure to accomplish measures #1 or #2 at the qualified level would result in the automatic failure of the objective. If the releasing gear was not properly engaged, then loss of the lifeboat and/or life would result.

A METHOD FOR DEVELOPING MARINER ASSESSMENTS

Chapter 3

A MANUAL FOR ASSESSMENT DEVELOPERS

This chapter describes a systematic, step-by-step method for developing Performance-based Assessment (PBA) of mariner proficiencies.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

ACKNOWLEDGMENTS

This manual represents the current point in an ongoing research and development project conducted by the United States Coast Guard (USCG) Research and Development Center for the USCG National Maritime Center over several years. The following sponsors, academy representatives, and industry representatives, and colleagues supported the development of this manual.

Mr. Perry Stutman of the United States Coast Guard National Maritime Center has provided continual support and guidance in the conduct of this project. Other members of the National Maritime Center, including Captain William Bennett, Mr. John Bobb, Mr. David Field, and Mr. Albert Kirchner also provided support and guidance during the course of this work.

Participants of early work that significantly influenced the orientation of the current effort include Captains George Sandberg, Richard Stewart, Douglas Hard, and Robert Meurn, all faculty members of the United States Merchant Marine Academy. More recently, members of maritime academies have collaborated on the development of sample assessment procedures which influenced the content of this manual. Significant contributions have been made by Captain Joseph Murphy and Ms. Emily Sporn of Massachusetts Maritime Academy; and Dr. Paul Jackson and Mr. Robert Hammaker of California Maritime Academy.

Representatives from the maritime industry have also reviewed early version of this manual. Special thanks go to Captains Thomas Blanchard and Nils Knutstad of SeaRiver Maritime, Inc.

CHAPTER 3 – A MANUAL FOR ASSESSMENT DEVELOPERS

Introduction	3-5
Instructions	3-6
1.0 Specify Assessment Objectives.....	3-7
1.1 Identify regulatory requirements	3-7
1.2 Analyze job requirements.....	3-7
1.3 Describe individual assessment objectives	3-7
2.0 Determine Assessment Methods	3-8
2.1 Identify alternatives assessment methods	3-8
2.2 Review the advantages and disadvantages of alternative assessment methods.....	3-9
2.3 Determine assessment methods.....	3-10
3.0 Specify Assessment Conditions	3-11
3.1 Describe assessment settings or scenarios	3-11
3.2 Specify oral and written questions	3-12
4.0 Develop Proficiency Criteria.....	3-13
4.1 Identify components of assessment objectives.....	3-13
4.2 Develop individual measures and standards	3-14
4.3 Develop proficiency criteria and scoring procedures.....	3-19
4.4 Validate measures, standards, proficiency criteria, and scoring procedures.....	3-22
5.0 Prepare the Assessment Materials.....	3-22
5.1 Prepare detailed assessment worksheets	3-23
5.2 Prepare assessor instructions	3-23
5.3 Prepare candidate instructions.....	3-24
5.4 Finalize oral and written questions.....	3-24
5.5 Finalize simulator and/or shipboard procedures	3-25
5.6 Document references, source materials, and the validation process	3-25
Implementation.....	3-25
Glossary.....	3-27
References	3-29

LIST OF ILLUSTRATIONS

Figure 1. General process for developing measures and standards.....	3-16
Figure 2. General process for developing proficiency criteria and scoring procedures.....	3-20

LIST OF TABLES

Table 1. Summary of <i>Lookout</i> assessment objectives.....	3-9
Table 2. General guidance on the selection of assessment methods.....	3-10
Table 3. Assessment method advantages and disadvantages.....	3-11
Table 4. <i>Lookout</i> assessment objectives and methods	3-12
Table 5. Summary of assessment conditions for <i>Lookout</i> assessment Objective 4	3-13
Table 6. Oral questions from the <i>Lookout</i> assessment.....	3-14
Table 7. Recommended information sources for identifying components of assessment objectives.....	3-15
Table 8. Examples of three categories of mariner actions or outcomes.....	3-17
Table 9. Example of a single measure and standard applied to an assessment action.....	3-19
Table 10. Example of multiple standards applied to a single action.....	3-20
Table 11. Examples of hypothetical assessment scores and results.....	3-22

INTRODUCTION

Meeting the requirements of the *Seafarers' Training, Certification and Watchkeeping Code (STCW Code)* is a current challenge of the United States maritime industry. The *STCW Code* directs the United States maritime industry to develop procedures for assessing mariner proficiency on the basis of practical demonstration. The *STCW Code* defines areas for which mariners must receive certification and specifies the need to assess proficiency on the basis of skill and knowledge demonstrations by the mariner. However, there has been an ongoing debate regarding what, precisely, is implied by the *STCW Code* directive for assessments that address:

. . . the proper performance of functions onboard ship in accordance with the internationally agreed criteria as set forth herein and incorporating prescribed standards or levels of knowledge, understanding, and demonstrated skill . . . (*STCW Code*, Section A-1/1, paragraph 1.1).

This chapter is intended to be used as a manual and be considered as such and is referred to as such throughout this chapter. The intent of this manual is to outline a process that can be used by professional mariners in training institutions and other organizations to develop mariner assessment procedures. The process described in this manual conforms to international standards and domestic regulations, especially the International Maritime Organization's *STCW Code* and the U.S. Coast Guard's *Navigation and Vessel Inspection Circulars* (NVICs) that address implementation of the *STCW Code* within the United States. The reference section of this manual lists specific STCW documents and applicable NVICs.

This manual is based on a comprehensive methodology for mariner assessment development documented in the first chapter of this report. The methodology is also presented in a set of workshop materials and exercises entitled *A Workshop for Assessment Developers* (Chapter 2). More generally, this manual relies heavily on the general method of *Instructional Systems Development* (ISD). More detailed reference information on all of the above sources is provided in the reference section of this manual.

The objective behind the process outlined in this manual is to develop *valid* and *reliable* mariner assessment procedures. Valid assessments evaluate mariners on the basis of their demonstration of job-critical knowledge, skills, and abilities. Valid assessments serve as accurate predictors of a mariner's abilities to fulfill the functional requirements of a job or task. Reliable assessments consistently obtain the same assessment results when different mariners with comparable skills are assessed. An assessment must be reliable and evaluate job-critical requirements in order to be valid.

The format of an assessment procedure is not essential to the validity and reliability of that procedure. Differences in organizational goals, assessment objectives, and performance standards preclude prescribing a single format for assessments. However, a sample assessment that proved to be useful during the development of this process is provided in this manual as an aid to the reader.

The remainder of this manual consists of a set of instructions for developing mariner assessment procedures, a glossary, a reference section, and a sample assessment procedure that is referred to

throughout the instructions. The instructions are intended to provide a relatively straightforward presentation of the steps needed to develop a valid and reliable assessment procedure. Issues critical to the validity and reliability of an assessment procedure are discussed, as necessary. The glossary provides a set of terms and definitions that are internally consistent with one another and, to the extent possible, consistent with current STCW, U.S. Code of Federal Regulations (CFR), and NVIC terms and definitions. The reference section identifies the international and domestic regulatory source documents; other manuals, authoritative books, and articles that address assessment development; and selected recent research on mariner assessment sponsored by the U.S. Coast Guard (USCG).

Instructions

This manual identifies a series of steps that can be conducted to develop a valid and reliable assessment procedure that meets International Maritime Organization (IMO) and USCG requirements for mariner demonstration of proficiency in selected areas. Following is an outline of the five basic steps and associated sub-steps described in this manual.

- 1.0 Specify Assessment Objectives.
 - 1.1 Identify regulatory requirements.
 - 1.2 Analyze job requirements.
 - 1.3 Describe individual assessment objectives.
- 2.0 Determine Assessment Methods.
 - 2.1 Identify alternative assessment methods.
 - 2.2 Review the advantages and disadvantages of alternative assessment methods.
 - 2.3 Determine assessment methods.
- 3.0 Specify Assessment Conditions.
 - 3.1 Describe assessment settings or scenarios.
 - 3.2 Specify oral and written questions.
- 4.0 Develop Proficiency Criteria.
 - 4.1 Identify components of assessment objectives.
 - 4.2 Develop individual measures and standards.
 - 4.3 Develop proficiency criteria and scoring procedures.
 - 4.4 Validate measures, standards, proficiency criteria, and scoring procedures.

5.0 Prepare the Assessment Materials.

- 5.1 Prepare detailed assessment worksheets.
- 5.2 Prepare assessor instructions.
- 5.3 Prepare candidate instructions
- 5.4 Finalize oral and written questions.
- 5.5 Finalize simulator and/or shipboard procedures.
- 5.6 Document references, source materials, and the validation process.

The following instructions are presented in a standard format to facilitate review and reference. Following the title of each step, the goal of the step is briefly described, followed by a listing of the sub-steps for that step. Then, separate instructions, discussions, and examples are presented to address the associated procedures, issues, and output.

1.0 Specify Assessment Objectives

Goal of this step

Identify the knowledge, skills, and abilities on which the mariner will be assessed.

Sub-steps

- 1.1 Identify regulatory requirements.
- 1.2 Analyze job requirements.
- 1.3 Describe individual assessment objectives.

1.1 Identify regulatory requirements

A mariner assessment procedure should be explicitly associated with a specific requirement in the *STCW Code*. The format of the *STCW Code* provides five levels of requirements that are readily identifiable, as shown in the following example:

Chapter: II – Standards regarding the master and deck department.

Table: A-II/1 – Specification of minimum standard of competence for officers in charge of a navigational watch on ships of 500 gross tonnage or more.

Function: Navigation at the operational level.

Competence: Plan and conduct a passage and determine position.

Knowledge, understanding and proficiency: Celestial navigation – Ability to use celestial bodies to determine the ship's position.

To specify the assessment objectives for an assessment procedure, begin by identifying all of the *STCW Code* requirements corresponding to these five levels. Later, this information will be included in the assessment documentation. In the *Lookout* assessment example in Appendix A, the *STCW Reference Information* entries in the *Assessment Control Sheet* provide similar

information from the *STCW Code*.

In developing an assessment to meet certification or licensing, other regulatory requirements should also be addressed. For example, the CFR provides explicit guidance regarding lifeboatman examination and demonstration of ability. If the assessment is intended to satisfy these additional regulatory requirements, the requirements should be explicitly addressed by the assessment and referred to in the assessment documentation.

1.2 Analyze job requirements

STCW Code and regulatory requirements typically will **not** provide sufficiently detailed information to support the development of a mariner assessment. To fill this gap, assessment developers should refer to technical manuals, job instructions, textbooks, and task analyses to aid in the identification of job requirements. If such sources are used to derive assessment objectives, they should be identified in the assessment documentation. For the present *Lookout* assessment example, the *STCW Code* specifies the following knowledge, understanding, and proficiency: “*Responsibilities of a lookout, including reporting the appropriate bearing of a sound signal, light, or other object in degrees or points.*” This information from the *STCW Code* was used to define the general requirements, which were augmented by a review of 46 CFR, Chapter 1, Subpart 97.27 – Lookouts, and by the *Navigation Rules* (Rule 2 – Responsibility and Rule 5 – Lookout). Rule 5 states: “*Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.*”

In most cases, an individual assessment area will be analyzed to identify a set of several related assessment objectives that will be addressed separately during a proficiency assessment. Each of these objectives should represent a critical component of the job requirement being analyzed. At this point, the goal is to identify those broad areas of knowledge, skill, and ability that are critical to successful job performance. Later, during Step 4.0, a more detailed task analysis will be conducted. There are numerous job analysis methods that might be used in defining assessment objectives. Further guidance on the conduct of job and task analysis can be found in selected references listed in this manual (e.g., Jonassen, Hannum, & Tessmer, 1989; Mager, 1997; Rothwell & Kazanas, 1998). Review of available texts, along with review and discussion from qualified professionals, should result in an adequate set of assessment objectives.

An individual assessment procedure must meet the stated *STCW Code* requirements and be appropriate in scope in order to be practically feasible. An assessment should address a single job requirement or integrated set of job requirements defined in the *STCW Code*. In addition, the time and resource requirements for assessment should be within a practical level. An assessment procedure is too broad in scope if it addresses a wide range of unrelated job requirements defined in the *STCW Code* and/or requires an unnecessarily extensive amount of time and resources.

1.3 Describe individual assessment objectives

Each assessment objective should include a general description of the mariner performance that will be required during assessment and the conditions under which they are to be performed. The performance should be described as a visible, overt action to be demonstrated to the assessor. At this point, conditions should identify any special characteristics of the assessment

setting, such as day or night conditions and major types of equipment or equipment settings required for the proficiency assessment. Table 1 lists the nine assessment objectives specified for the *Lookout* assessment. This example illustrates very broad condition descriptions, limited to day, night, and restricted visibility conditions.

Table 1. Summary of *Lookout* assessment objectives.

1. Describe lookout duties and responsibilities.
2. Identify lookout stations and safe routes onboard.
3. Describe and identify the international distress signals.
4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.
5. Demonstrate lookout techniques and make lookout reports in clear visibility at night.
6. Demonstrate lookout techniques and make lookout reports in restricted visibility.
7. Demonstrate the use of lookout equipment.
8. Demonstrate man overboard procedures.
9. Demonstrate lookout watch relief procedures.

2.0 Determine Assessment Methods

Goal of this step

Select the most appropriate method for conducting the assessment of each objective.

Sub-steps

- 2.1 Identify alternative assessment methods.
- 2.2 Review the advantages and disadvantages of alternative assessment methods.
- 2.3 Determine assessment methods.

2.1 Identify alternative assessment methods

The intent of the STCW Code is to foster assessment through practical demonstration. Thus, it is important that assessment developers carefully consider the alternative assessment methods available to them and attempt to select the method that best meets the intent of the STCW Code, while also considering the practical limitations of mariner assessment.

This step begins with the consideration of alternative assessment methods for each assessment objective identified in the preceding step. There are three basic methods of assessment:

- Oral or written questions.
- Exercises in a simulated job setting.
- Exercises in an actual shipboard job setting.

Oral or written questions ask the candidate to respond to factual questions regarding general or

job-specific knowledge. Simulated job settings vary widely in the extent to which they accurately present cues from work settings and require candidates to respond in the same manner as onboard ship. Assessments conducted in the actual shipboard job setting provide the candidate with actual work setting cues and require candidate responses that reflect actual job requirements. The reader should note, however, that even in an actual shipboard job setting, the conditions of assessment frequently are modified from non-assessment conditions. For example, at the onset of assessment it might be necessary to provide the candidate with a more explicit explanation of the current situation than is typically provided during normal operations.

At the most general level, there are two basic categories of *what* is being assessed by an assessment procedure, as summarized in Table 2. First, an assessment can evaluate the candidate's demonstration of *knowledge* of concepts, constructs, rules, and procedures. Often, specific areas of knowledge can be identified as a prerequisite to proficiency in job performance. In such cases, assessment of a candidate's knowledge is appropriate. Second, an assessment can evaluate the candidate's demonstration of *skills and ability* to apply knowledge of concepts, constructs, rules, and procedures in an operational setting. Demonstration of ability in operational settings provides a much more *valid* basis of assessment. However, sometimes the assessment of knowledge demonstration in a non-operational setting is more appropriate, due to economic, efficiency, or safety concerns.

The general category of *what* is being assessed corresponds to the general *method* of mariner assessment, as summarized in the right-hand column of Table 2. As presented here, oral or written questions are used to assess the mariner's demonstration of knowledge. Simulated or actual shipboard job settings are used to assess the mariner's demonstration of the ability to apply knowledge in an operational setting.

Table 2. General guidance on the selection of assessment methods.

What is Being Assessed	Method of Mariner Assessment
Knowledge of concepts, constructs, rules, and procedures	Oral or written questions
Skills and ability to apply knowledge in an operational setting	Practical demonstration in real or simulated operations

2.2 Review the advantages and disadvantages of alternative assessment methods

Once the alternative assessment methods have been identified, the assessment developer should consider the advantages and disadvantages of each alternative. Factors to consider are assessment validity, assessment reliability, ease of assessment development, and ease of assessment administration. Recall that a *valid* assessment is one that represents critical performance in the operational setting. A *reliable* assessment is one that produces consistent results from assessor to assessor, and candidate to candidate. Table 3 summarizes some of the common advantages and disadvantages associated with each of the three general assessment methods.

Table 3. Assessment method advantages and disadvantages.

Method	Advantage	Disadvantage
Oral or written questions	Easy to standardize Easy to test many at once Good measure of knowledge	May not adequately represent actual requirements of work setting (validity)
Simulator demonstration	High reliability Safe May have high validity	May not adequately represent actual requirements of work setting (validity) May be expensive Usually need one assessor per candidate
Shipboard demonstration	High validity	Usually need one assessor per candidate More difficult to control conditions (reliability) Task may be infrequent or dangerous

2.3 Determine assessment methods

The assessment developer should consider each assessment objective and, in turn, determine an assessment method. The specification of the assessment method should include a general description of the assessment method and assessment conditions for each objective. Assessment methods and conditions must reflect a reasonable level of operational job requirements. The assessment methods must also provide a means of maintaining sufficient control over events so that mariner safety is ensured and operational risks are minimized.

The assessment methods defined for the *Lookout* assessment were initially divided between (1) oral or written questions and (2) practical demonstration in shipboard or simulated operations. This provided flexibility for future applications in the use of either oral or written and either simulator or shipboard assessment. Table 4 summarizes the assessment method selected for each *Lookout* assessment objective from the sample assessment procedure.

Table 4. Lookout assessment objectives and methods.

Assessment Objective	Assessment Method
Describe lookout duties and responsibilities.	Oral or written questions
Identify lookout stations and safe routes onboard.	Oral or written questions
Describe and identify the international distress signals.	Oral or written questions
Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.	Practical demonstration – shipboard and/or ship bridge simulator
Demonstrate lookout techniques and make lookout reports in clear visibility at night.	Practical demonstration – shipboard and/or ship bridge simulator
Demonstrate lookout techniques and make lookout reports in restricted visibility during daylight or at night.	Practical demonstration – shipboard and/or ship bridge simulator
Demonstrate the use of lookout equipment.	Practical demonstration – shipboard and/or ship bridge simulator
Demonstrate man overboard procedures.	Practical demonstration – shipboard and/or ship bridge simulator
Demonstrate lookout watch relief procedures.	Practical demonstration – shipboard and/or ship bridge simulator

3.0 Specify Assessment Conditions

Goal of this step

Outline the assessment conditions for the candidate and assessor.

Sub-steps

- 3.1 Describe assessment settings or scenarios.
- 3.2 Specify oral and written questions.

3.1 Describe assessment settings or scenarios

Following the determination of assessment objectives and methods, the assessment developer should begin preparing a more detailed description of *how* the assessment will be conducted. The assessment conditions provide a good point of departure for this detailed specification. The following should be included in a detailed description of the assessment conditions:

- Assessor instructions.
- Candidate instructions.
- Test conditions, tools, and apparatus used by candidate.

- Specific simulator scenario requirements.
- Requirements for shipboard operations.

The assessor instructions should address special assessment requirements for which the assessor needs to prepare in advance. In the case of simulator-based assessments, this includes familiarization with the controls, displays, and outputs of the simulator. In the case of shipboard assessments, it includes specific operational conditions required to ensure a valid and reliable assessment. For example, if a lookout assessment is being conducted onboard a vessel, it may be necessary to have a specific number of targets visible during the course of the assessment. In addition, issues of personnel safety, operational risk, and operational efficiency should be identified at this point.

Candidate instructions should provide the candidates with the information they will need to prepare for assessment. If simulators are being used, a detailed description of the operational scenario should be provided, specifying both the initial settings of equipment and how the candidate will be allowed to operate controls during the course of the assessment. For shipboard assessment, the operations under which assessment is to be conducted must be described and the initial settings of operational equipment should also be specified. This description requires comparable detail to that for simulator assessment, although the ability of the assessor to control these conditions may be more limited. Table 5 provides a summary of the assessment conditions described for *Lookout* assessment Objective 4.

Table 5. Summary of assessment conditions for *Lookout* assessment Objective 4.

Assessment Objective	Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.
Initial Condition	The assessment should be conducted in clear visibility during daylight. It is essential that reportable objects are in sight.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7 X 50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or peloris. The lookout station should be clear and the assessor must be able to observe activities.

3.2 Specify oral and written questions

Oral and written questions should be adequately specified to ensure comprehensive and consistent assessment. The topics to be addressed by the set of questions should be adequately defined so that this part of the assessment will address a common set of concepts, constructs, rules, or problem-solving skills from one assessment to the next. In the best case, a library of test items will be developed, along with procedures for sampling from this library for any assessment. At a minimum, the number of questions should be identified, as well as the topics and subtopics for subsets of questions. In addition, the type of question (e.g., open-ended, multiple-choice, fill-in, and essay/discussion) should be specified.

Table 6 lists the oral questions included in the *Lookout* assessment, providing more detail on the assessment objectives and methods identified in Table 4. These questions address assessment

Objectives 1, 2, and 3. The question format is open-ended. The candidate is instructed to provide complete answers, and the assessor is asked not to provide coaching or feedback during the questioning period.

Table 6. Oral questions from the *Lookout* assessment.

Assessment Objective	Written or Oral Test Questions
1. Describe lookout duties and responsibilities.	What are the duties and responsibilities of the lookout?
2. Identify lookout stations and safe routes onboard.	Identify three common lookout stations on this vessel. Identify the safe routes to the bow lookout station on this vessel.
3. Describe and identify the international distress signals.	Describe and identify six international distress signals.

4.0 Develop Proficiency Criteria

Goal of this step

Specify the criteria that will be used to assess mariner proficiency, including the measures, standards, proficiency criteria, and scoring procedures.

Sub-steps

- 4.1 Identify components of assessment objectives.
- 4.2 Develop individual measures and standards.
- 4.3 Develop proficiency criteria and scoring procedures.
- 4.4 Validate measures, standards, proficiency criteria, and scoring procedures.

4.1 Identify components of assessment objectives

To this point, assessment objectives have been defined that correspond to basic job requirements identified in the *STCW Code*, other regulatory requirements, or job/task descriptions. The performance required by an objective may need to be broken into smaller, more discrete components for assessment purposes. The separate components of an objective consist of knowledge and/or application of concepts or constructs, rules of operation, or procedures for operation. Separate sources of information are available to assist in the identification of components corresponding to each of these three types.

Three separate information sources are recommended in Table 7 for each type of assessment objective component, with each set including a type of expert. In general, it is recommended that broadly referenced sources (i.e., textbooks, regulations, and technical manuals) be reviewed first. These can be followed by more specific references developed for particular applications (i.e., course materials, company policy, and ship manuals). Finally, experts (i.e., training experts, regulation and policy experts, and operational experts) should be consulted. Information

that is more specific to a course, company, or ship is often required to identify assessment components that realistically reflect job requirements. Frequently, limited reference material will be available, requiring greater reliance on expert input. It is critical to ensure the validity of expert information because there are many perspectives regarding concepts, interpretations of rules, and operationally specific steps and procedures. Assessment should address *commonly accepted* assessment objective components. Therefore, experts should be selected with care, and input from multiple sources should be obtained and compared.

Table 7. Recommended information sources for identifying components of assessment objectives.

Type of Assessment Objective Component	Recommended Information Sources
Concepts or constructs	Textbooks Course materials Training experts
Rules of Operation	Regulations Organizational policies Regulation and policy experts
Steps or Procedures of Operations	Technical manuals Ship manuals Operations experts

For the *Lookout* assessment, three components of assessment Objective 8, *Demonstrate man overboard techniques*, were identified on the basis of a review of ship manuals and interviews with operations experts. These were (1.) throw a ring life buoy, (2.) sound the alarm, and (3.) keep the victim in sight at all times.

4.2 Develop individual measures and standards

Reliable and valid assessment requires the consistent measurement of mariner performance and the consistent application of relevant performance standards. This process can sometimes be relatively complex. As a consequence, the following discussion is the most involved in this manual. The instructions for measure and standard development rely upon the definition of several key terms, as discussed in the following paragraphs.

A *performance measure* is a description of how a candidate's performance is to be observed and recorded. A useful distinction between types of measures contrasts instrumented and observational measures. An *instrumented measure* relies upon apparatus that can be calibrated to yield highly consistent and accurate measurement results. Examples of apparatus used in instrumented measurement are stopwatches, compasses, rudder angle indicators, oil pressure gauges, and volt meters. An example of an instrumented performance measure is the time required for launching a lifeboat. A complete description of how this measure is to be applied includes (1) how to signal the start of the launching assessment, (2) when to start the timer, (3) the type of timer used and its calibration, and (4) when to stop the timer and record the launch.

time. Whenever practical and meaningful, instrumented measures should be used in assessment because they provide the most reliable means of measurement.

An *observational measure* relies primarily on the assessor's observation and interpretation of mariner performance. In applying an observational measure, an assessor will observe and categorize the mariner's performance with reference to an established standard. A description of how an observational measure is to be applied is comprised of the recording form and the instructions for how to interpret the observed performance. Although not as inherently consistent and accurate as instrumented measures, the consistency and accuracy of observational measures can be greatly enhanced by carefully describing how the assessor should apply the established standards to the observed performance.

A *performance standard* is the level of a measure that is established as an acceptable or target level. In the case of an instrumented measure, the acceptable level is established independently of the observational procedure. For the example above describing the observation of the time to launch a lifeboat, the standard would be an established time limit that must be met for acceptable performance. In the case of an observational measure, the standard is established as a part of the observational procedure. If the assessor interprets the observed performance as matching the important characteristics of the established standard, the performance is acceptable.

Figure 1 outlines a general procedure for developing measures and standards. The process is linear, with the exception of one branch that must be taken on the basis of the type of performance measure that is used. The following discussion describes each step in this process.

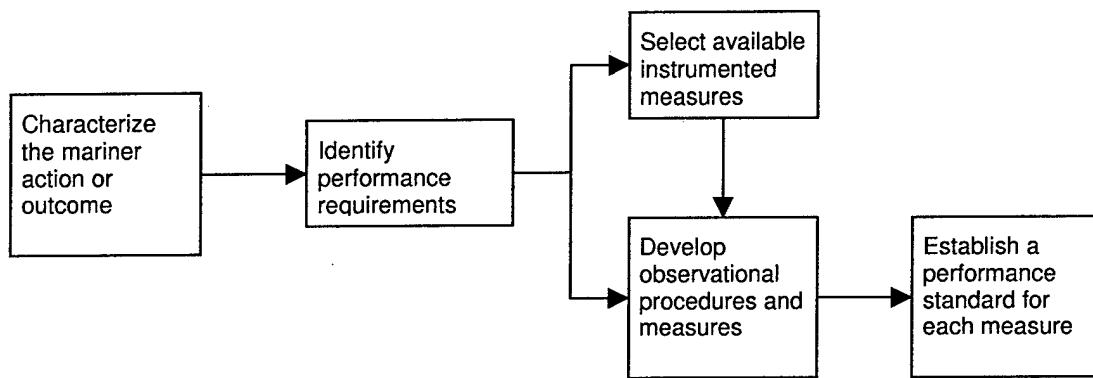


Figure 1. General process for developing measures and standards.

Characterize the mariner action or outcome. The first step in this process is to characterize the actions, or outcomes of actions, performed by the mariner into one of three categories. First, the mariner's action may be a verbal or written response to a question. Second, the mariner's action may be the performance of a sequence of operational actions. Third, the mariner's action may result in an outcome that can be readily observed by the assessor. The characteristics of each mariner action or outcome should be described to allow subsequent consideration of the corresponding performance requirements. Table 8 provides examples of actions and outcomes that are best characterized by one of these three categories.

Table 8. Examples of three categories of mariner actions or outcomes.

Category of Mariner Action or Outcome	Example Descriptions
Verbal or written response to question	Verbal response to question: <i>What are the duties and responsibilities of the lookout?</i>
Sequence of operational actions	Keep the victim (person overboard) in sight at all times
Action resulting in an observable outcome	Report sighted objects verbally using degrees

Identify performance requirements for each action or outcome. The second step is to identify the performance requirements of each mariner action or outcome. Here, a performance requirement is an aspect or characteristic of the action or outcome required for successful job performance. A mariner action or outcome may have a single requirement or it may have several requirements. An example of an action with a single requirement from the *Lookout* assessment is *Call the bridge if you are not properly relieved*. The single requirement is to notify the bridge. An example of an action with multiple requirements for the *Lookout* assessment is *Reports sighted objects verbally using degrees*. This action requires the lookout's reporting (1) a minimum number of objects, (2) what each object is, (3) where each object is, and (4) how far away each object is. During this step, separate performance requirements will be identified. During the next two steps, separate measures corresponding to each requirement will be established.

Select instrumented measures when available. Because instrumented measures are inherently more objective, reliable, and free of observer bias, they should be selected for use in assessments whenever available. In the present *Lookout* example of *Reports sighted objects verbally using degrees*, the use by the assessor of a bearing repeater, or some other device providing accurate bearings, is indicated. In the engine room environment, many actions rely on the reading of calibrated indicators or the operation of calibrated controls. In this case, the instruments are readily available to the assessor to support many of the performance measures.

Develop observational procedures and measures. All performance measures depend upon observation by an assessor. Thus, observational procedures should be specified in all cases where they are not readily understood in advance. If the assessor is using observation based on a reading from an instrument, there will typically be standard procedures for observation. For example, accurate reading of many indicators requires that the observer's eyes be positioned directly above the pointer to avoid the affects of parallax, or apparent displacement. In addition, it will often be necessary to specify the instrumented measure to be used by the assessor. For example, using a bearing repeater to measure performance of *Reports objects verbally using degrees* includes the recording of the deviation, in degrees, between the reported and actual bearing of the target.

Observational measures require special attention in the development of observational procedures. Here, the measure is actually defined on the basis of the explicit observational procedures. In the case of verbal or written questions, this will commonly involve specifying the question to be asked by the assessor. For example, the measure for the *Lookout* action *Identify and describe the international distress signals* consists of the question asked by the assessor *Identify and describe*

six international distress signals. In the case of the observational measure of actions or outcomes, the development of observational procedures requires specifying the individual steps or characteristics of performance. For the *Lookout* example, *Reports sighted objects verbally using degree*, this development involves specifying the assessor's procedure for observing each identified performance requirement. These include (1) counting the number of objects reported, (2) noting the reported and actual type of each object reported, (3) recording the reported and actual bearing of each object, and (4) noting the reported and actual distance of each object.

Establish a performance standard for each measure. Then, it is necessary to establish a performance standard for each measure. The standard is extremely critical to the effectiveness of the assessment in ensuring the proficiency of the mariner. In developing standards for STCW certification, the criterion for proficiency specified in that document is an important first source. Other sources for establishing standards are the same ones used for establishing the assessment objectives and for breaking them into components. These include government regulations, technical manuals, job instructions, textbooks, and task analyses. Finally, appropriate experts can and should be consulted. The standard of performance for each measure should be consistent with important sources and expert opinion. In the case of instrumented measures, this standard should reflect the instrument's unit of measurement. As an example, in the case of the *Lookout* measure of reporting the sighted object's bearing, the standard was established that *Reports must be within 22.5 degrees of the actual bearing of targets.* The experts who established this standard considered the consequences of inaccurate lookout reports. Based on that consideration, it was determined that a report that directed the officer of the watch to a 45 degree area would be adequate to meet the requirement for *a full appraisal of the situation and of the risk of collision* (from Rule 5 of the *Navigation Rules*).

Establishing performance standards for observational measures follows an analogous process to that for instrumented measures. However, in this case, the unit of measure and standard are typically defined together. For oral or written questions, this will require a definition of acceptable answers. For example, for the *Lookout* measure “Answers question *Identify and describe six international distress signals*,” the following potential answers are predefined; and the standard of having the candidate correctly recall six distress signals was established on the basis of expert review.

- Red star shells
- Flames on a vessel
- Orange background black ball & square
- “Mayday” by radio
- Dye marker (any color)
- Square flag and ball
- Radio-telephone alarm
- Smoke
- Fog horn continuing sounding
- Gun fired at intervals of 1 minute
- SOS
- Parachute red flare
- Code flags November Charlie
- Wave arms
- Position indicating radio beacon

When the observational measure is based on the assessor's observation of procedural steps or outcomes, it is sometimes much more difficult to predefine all alternative mariner actions. However, when possible, guidance should be provided in the assessment procedure. For example, in establishing the standard for the *Lookout* measure *Report how far off the sighted*

object is, the standard is *correctly reporting using one of four alternative statements (hull-down, on the horizon, hull-up, or close aboard)*. In other cases, the expertise of the assessor must be relied upon to determine if the candidate's performance meets the standard. For example, the *Lookout* assessment requires correct reporting of *what type of object*. Here, it is left to the assessor's expert judgment to determine if the lookout's report provides sufficient information to meet the proficiency criterion as intended in STCW and other sources.

While the ISD literature describes a variety of approaches to developing performance standards, only "pass/fail" standards are described here. During assessment trials, it was determined that the pass/fail approach was the most practical for the assessor doing the over-the-shoulder assessment. In the simplest case, there will be a single pass/fail standard for a single measure and a single action. Table 9 is an excerpt from the *Lookout* assessment that illustrates such a case. Here, if six or more correct international distress signals are recalled, the candidate's performance meets that standard for Action 3.1, or "passes;" if fewer than six are recalled, the candidate's performance fails to meet the standard for.

Table 9. Example of a single measure and standard applied to an assessment action.

Action	Performance Measure	Performance Standard
3.1 Identify and describe the international distress signals	Answers question: <i>Identify and describe six international distress signals.</i>	Identifies and describes six of the following: <input type="checkbox"/> Red star shells <input type="checkbox"/> Fog horn continuing sounding <input type="checkbox"/> Flames on a vessel <input type="checkbox"/> Gun fired at intervals of 1 minute <input type="checkbox"/> Orange background black ball & square <input type="checkbox"/> SOS <input type="checkbox"/> "Mayday" by radio <input type="checkbox"/> Parachute red flare <input type="checkbox"/> Dye marker (any color) <input type="checkbox"/> Code flags November Charlie <input type="checkbox"/> Square flag and ball <input type="checkbox"/> Wave arms <input type="checkbox"/> Radio-telephone alarm <input type="checkbox"/> Position indicating radio beacon <input type="checkbox"/> Smoke

When multiple measures and standards are developed for a single action, each of the individual standards must be met to pass the requirements for that action. Table 10 is an excerpt from the *Lookout* assessment that applies this more complex scoring procedure. In this case, the candidate must correctly report (1) a minimum of three objects, (2) what (type of object), (3) where (within 22.5 degrees), and (4) how far off (hull-down, on the horizon, hull-up, or close aboard) to meet

the set of multiple standards.

Table 10. Example of multiple standards applied to a single action.

Action	Performance Measure	Performance Standard
4.3 Report sighted objects verbally using degrees	Reports sighted objects verbally using degrees	<ul style="list-style-type: none"><input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects.<input type="checkbox"/> What (type of objects).<input type="checkbox"/> Where (bearings, relative or true). Reports must be within 22.5° of the actual bearing of detected targets.<input type="checkbox"/> How far-off (hull-down, on the horizon, hull-up, close aboard). <p>Failure of any of the above four standards constitutes failure.</p>

4.3 Develop proficiency criteria and scoring procedures

Mariner proficiency refers to an individual's demonstrated ability to meet the job performance requirements. Up to this point in the development of assessment procedures, job requirements have been analyzed to identify individual assessment objectives and these have been further analyzed into component actions. Each action has been reviewed to identify appropriate performance requirements, and individual measures and standards have been developed. For each action, a pass/fail standard has been developed. Now, *proficiency criteria* should be developed for each assessment objective that combine the standards for individual actions on the basis of the action's *job criticality*. Figure 2 outlines the general process for developing proficiency criteria and scoring procedures. This process involves separate, parallel paths for *critical* and *non-critical* actions, concluding with the development of a combined proficiency criteria and scoring procedure for a single assessment objective. The following discussion describes this process.

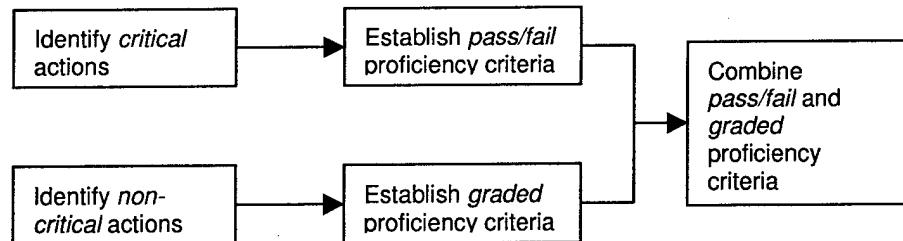


Figure 2. General process for developing proficiency criteria and scoring procedures.

Identify critical actions. The first step in developing proficiency criteria and scoring procedures requires a final consideration of the criticality of the action being assessed. The key consideration is whether the action is essential to safe and/or effective job performance. An example of a critical action is in the *Demonstrate man overboard procedures* objective of the *Lookout* assessment. Successfully meeting the three standards of (1) *establishes and maintains visual contact*, (2) *points in the direction of the person in the water*, and (3) *remains on station until he or she is properly relieved or ordered otherwise* are all considered essential to safety. All actions under a single assessment objective should be considered individually and all critical actions identified.

Establish pass/fail proficiency criteria. Because critical actions are essential for safe and/or effective job performance, a pass/fail proficiency criterion should be established for each of these. That is, failure to meet the standard(s) corresponding to that action will be established as sufficient for failing the proficiency criteria of the corresponding assessment objective. Continuing with the *Lookout* objective *Demonstrate man overboard procedures*, failure to meet the standards for the action *Keep the victim in sight at all times* was established as sufficient for failure of this objective.

Identify non-critical actions. The lower path in Figure 2 is taken for those actions that correspond to non-critical job requirements. Here, meeting the standards for each action is not essential to operational safety and/or effectiveness. For example, everyone is familiar with driver's license tests that have established passing rates, such as 80 percent. In these cases, the assessment typically addresses a procedure that includes safety redundancies or a broad area of knowledge where general, not perfect, understanding and comprehension is established as the target. In the present *Lookout* example, all actions were determined to be critical. However, other, non-critical lookout actions could be identified as part of an assessment of lookout proficiency.

Establish graded proficiency criteria. If a related set of non-critical actions has been identified for an assessment objective, it may be most appropriate to develop one or more sets of graded proficiency criteria. The related set of actions should be reviewed by operational experts, who should assess the risks associated with failure in meeting the standards associated with each action. Then, based on this review, a proficiency criterion should be established for the related set of actions. If more than one set of non-critical, related actions is identified within a single assessment objective, this process should be repeated for each of these sets.

As noted above, the present *Lookout* example does not include non-critical actions. However, subsequent refinement of this assessment for application aboard commercial vessels resulted in the combination of five related *Lookout* assessment objectives. All five of these objectives were judged to involve interrelated knowledge and understanding requirements, and a single proficiency criterion of 80 percent correct was established for the entire set. The reader can refer to these related assessment procedures in McCallum, Barnes, Forsythe, and Smith, 2000.

Combine pass/fail and graded proficiency criteria. The final box in Figure 2 denotes the development of a proficiency criterion across all critical and non-critical actions for the assessment objective under consideration. There are three possible strategies that must be considered at this point, as presented by the hypothetical examples of assessment scores and results in Table 11. If only critical actions have been identified, then a corresponding proficiency criterion can be established that requires the candidate to receive a passing score on

all actions for the corresponding assessment objective. The assessment objective *demonstrate man overboard procedures* is such an example. Here, all three actions were determined to be critical. Thus, the resulting proficiency criterion for this assessment objective requires the candidate to pass the individual standards corresponding to each of the three actions. A hypothetical example of this case is shown in the “All Critical” column of Table 11. For this case, meeting the standards for eight actions corresponds with a score of 8 and a result of not meeting the proficiency criterion for the assessment objective (i.e., failing).

Table 11. Examples of hypothetical assessment scores and results.

Assessment Objective		Criteria, Procedures, & Results	Examples with Different Criticality of Actions		
Action	Score		All Critical	All Non-critical	Critical & Non-critical
	Pass Fail				
1.	<input checked="" type="checkbox"/> <input type="checkbox"/>	Proficiency Criteria	Actions 1-10 (critical): 100%	Actions 1-5 (non-critical): 80%	Actions 1-5 (critical) 100%
2.	<input checked="" type="checkbox"/> <input type="checkbox"/>			Actions 6-10 (non-critical): 60%	Actions 6-10 (non-critical) 60%
3.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
4.	<input type="checkbox"/> <input checked="" type="checkbox"/>				
5.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
6.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
7.	<input type="checkbox"/> <input checked="" type="checkbox"/>				
8.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
9.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
10.	<input checked="" type="checkbox"/> <input type="checkbox"/>				
		Scoring Procedures	Actions 1-10 = 80% FAIL	Actions 1-5 = 80% PASS	Actions 1-5 = 80% FAIL
				Actions 6-10 = 80% PASS	Actions 6-10 = 80% PASS
		Assessment Result	Apply criterion for assessment objective FAIL	Apply both criteria for assessment objective PASS	Apply both criteria for assessment objective FAIL

When only non-critical actions have been identified, a single graded proficiency criterion or combined set of graded proficiency criteria should be established. If a single set of interrelated actions is identified, a single graded proficiency can be established. However, if analysis of the set of actions reveals two or more independent sets of actions, each with unrelated implications of failure, then two independent sets of graded proficiency criteria should be established. A hypothetical example of the latter case is presented in the “All Non-critical” column of Table 11. For this case, scores of 80 percent for the two sets of Actions 1-5 and Actions 6-10, result in meeting both criteria for the assessment objective.

Finally, when both critical and non-critical actions are identified, then the individual sets of actions must be considered separately in establishing proficiency criteria and scoring procedures. The last column in Table 11 presents this example. For this case, Actions 1-5 are critical and require passing each action; and Actions 6-10 are non-critical, requiring a 60 percent passing rate. Combining these two scoring procedures results in not meeting the proficiency criterion for the assessment objective.

4.4 Validate measures, standards, proficiency criteria, and scoring procedures

The proficiency criteria corresponding to each assessment objective must be validated in a manner that ensures that assessment will be conducted consistently and represent the requirements of the job. Proficiency is, in the end, a judgment that takes into account both the risks associated with sub-optimal performance and the costs of requiring optimal performance of all mariners. A commonly accepted means of establishing the validity of an assessment procedure is to convene a meeting of experts who formally review and reach consensus on the validity of the assessment. Within large organizations, it is often most efficient to establish a standing committee to review and validate new or updated assessment procedures. If this approach is not efficient, it may be best to establish either a standing or ad hoc committee from among several organizations.

Validation of an assessment procedure requires that experts in the relevant proficiency independently review each of the assessment development steps up to this point, discuss their areas of concern, and reach agreement that the final assessment procedure will provide a reliable and valid means of assessing mariner proficiency. The validation process can become time-consuming and inefficient if it is not managed effectively. However, if it is managed effectively and all critical issues are considered and agreed upon, the resulting assessment procedure will have a much greater and more enduring value. Refer to the reference section for texts that address procedures for validation (e.g., Jonassen, Hannum, and Tessmer, 1989; Rothwell and Kazanas, 1998). Basic requirements of an adequate validation process based on committee review are summarized below:

- Assemble a committee of at least three members who are fully qualified and experienced in the area of proficiency under consideration.
- Ask the committee to discuss and/or observe performance of the job and tasks associated with the assessment objectives in both realistic work settings and the proposed assessment conditions.
- Ask each expert to consider and comment independently on the acceptability of the assessment objectives, conditions, measures, proposed standards, and proposed proficiency criteria.
- Ask the committee members to review and discuss issues until agreement among all members of the group has been established.

A final recommended step in validation is trial application of the procedure. Here, draft versions of the assessment are used on a trial basis to identify issues that would not be recognized otherwise. This final step is addressed in the final discussion of implementation issues that follows.

5.0 Prepare the Assessment Materials

Goal of this step

Prepare all materials and tools so that they are ready for use by an assessor and candidate.

Sub-steps

- 5.1 Prepare detailed assessment worksheets.
- 5.2 Prepare assessor instructions.
- 5.3 Prepare candidate instructions.
- 5.4 Finalize written and oral test questions.
- 5.5 Finalize simulator and/or shipboard procedures.
- 5.6 Document references, source materials, and validation process.

5.1 Prepare detailed assessment worksheets

The assessment materials must be prepared as stand-alone procedures that can be administered by assessors who are not familiar with the development process. This will help to yield valid and reliable assessment results. The central assessment materials are the written procedures or worksheets that will be used by the assessor while conducting the assessment. These worksheets should be prepared first, since they will likely be referred to in all of the other assessment materials. The present *Lookout* example has a series of seven worksheets, each of which corresponds to one or more assessment objectives. Each worksheet is formatted into three sections, consisting of (1) identifying information, (2) scoring and recording procedures, and (3) comments that provide succinct instructions for the assessor.

The assessment worksheet should provide sufficient information to guide the assessor through the assessment procedure, as well as a means of recording the outcome corresponding to the individual objectives, objective components, measures, and standards. It should be noted that detailed assessor instructions could take the place of highly elaborate assessment worksheets. That is, much of the information required for conducting an assessment can be included in the assessor instructions, with only the minimum necessary for recording the results of the assessment included in the worksheet. On the other hand, assessor instructions can be limited to the necessary information, with more detailed guidance provided directly on the worksheet. This choice should be based on a consideration of the amount of assessment training available to assessors and the amount of information that can be reasonably included in these two documents, among other considerations.

5.2 Prepare assessor instructions

Every set of assessment materials should include a set of assessor instructions. In many cases, detailed step-by-step instructions help to ensure the reliability and validity of the resulting assessment. Although proficient mariners should be conducting the assessment, there can be many interpretations of how an assessment is to be conducted, especially with regard to candidate instructions, equipment set-up, timing and pace of assessment activities, and interaction between the assessor and candidate.

The assessor instructions could include the following topics:

- Prepare for assessment.
- Conduct pre-briefing with the candidate.

- Observe performance and record results.
- Determine assessment outcome.
- Conduct assessment debriefing.
- Special assessment instructions.

The *Lookout* assessment includes an assessor instructions checklist (see the assessment procedure at the back of this manual) that provides detailed guidance on conducting the *Lookout* assessment, following the topics outlined above.

5.3 Prepare candidate instructions

The set of assessment materials should also include separate, self-contained candidate instructions that can be provided to the candidate well in advance of when the assessment is conducted. At a minimum, the candidate instructions should include:

- Assessment objective source – *STCW Code* chapter, table, function, competence, and proficiency.
- Assessment objective(s).
- Assessment method(s).
- Conditions under which the assessment will be conducted (equipment status, underway versus in port, etc.).
- Assessment procedures, in terms of who will administer the assessment and how long it will take.
- A summary of the measures and standards that will be used to determine the outcome of the assessment.

The *Lookout* assessment includes a set of candidate instructions (see the assessment procedure at the back of this manual) that address what will take place during the pre-assessment briefing, performance observation and recording, and determination of the assessment outcome.

5.4 Finalize oral and written questions

As noted earlier in the discussion of sub-step 3.2 – *Specify oral and written questions*, written items should be documented by either defining detailed question objectives or developing a library of questions. The assessment developer must be aware of the dangers of inadequate specification of oral and written questions. *Without a detailed set of questions, the performance measures are not defined and any performance standards are arbitrary.* At a minimum, the specific knowledge areas to be assessed should be defined, along with the format of the assessment items (i.e., true/false, multiple-choice, short answer, or essay/discussion) and the number of items that should be included for each knowledge area. The developer should consider providing a detailed list of specific oral and/or written questions, along with the correct answers for each question.

5.5 Finalize simulator and/or shipboard procedures

Just as it is necessary to detail written and oral test questions, detailed procedures for simulator and/or shipboard assessment procedures should also be finalized in the assessment materials. When simulators are used, specific assessment scenarios or scripts should be developed. In addition to performance measurement and recording procedures, fully documented simulator scripts or scenarios might include the following specifications:

- Simulated time of day and weather conditions.
- Own vessel status at the start of the scenario.
- Other vessel locations at the start of the scenario.
- Sequence and timing of own vessel malfunctions, if any.
- Course, speed, and maneuvers of other vessels, if any.

In the case of shipboard assessment, a special concern is the need to develop a detailed plan for the assessment. It will be necessary to find a balance between *controlling* and *selecting* the conditions of assessment. The shipboard assessment procedures should detail both what conditions the assessor should establish in advance of the assessment and what conditions must be taken advantage of or avoided when conducting an assessment during normal operations. Documentation of shipboard assessment procedures should include a worksheet that provides space and instructions for the assessor regarding the following items, as applicable:

- Critical safety issues.
- Equipment initialization and set-up.
- Recording of own vessel conditions (date, time, location, course, speed, equipment status).
- Environmental conditions.
- Traffic conditions.
- Cues to be provided to the candidate by the assessor or equipment.
- Performance to be observed and recorded.

5.6 Document references, source materials, and the validation process

The final step in preparing the assessment materials is to document references, source materials, and the validation process. This last step serves two purposes. First, it provides the necessary references and documentation to allow either the assessment developer, or a successor, to maintain and update the assessment procedure. Second, this documentation provides necessary reference material to assist an external reviewer who may evaluate the assessment procedure.

Implementation

When all assessment materials are prepared, the assessment procedure is ready for implementation. Implementation may be as straightforward as handing the document over to the

assessor to begin use in assessing candidates. Or implementation may involve a more complex process that requires several iterations of trial application and refinement before the procedures are ready to serve their function in mariner assessment. More than likely, some intermediate level of trial application and refinement will be required prior to full implementation. Additionally, assessment developers and assessors must remain cognizant of changes in operational equipment, procedures, or regulatory requirements that will necessitate future revisions to the implemented assessment procedures. Issues concerning the implementation of assessment procedures and the conduct of assessments are addressed in a companion manual, *Conducting Mariner Assessments* (McCallum, Barnes, Forsythe, & Smith, 2000).

GLOSSARY

Assessor. Anyone who conducts an *assessment* or evaluation of an individual's *proficiency*. Although the use of the term assessor is retained in some discussions of STCW requirements including NVIC 4-97 on company roles and responsibilities, the term *designated examiner* is used for assessor in the U.S. implementing regulations.

Assessment. The process of evaluating whether an individual's performance meets established *proficiency criteria*. The terminology used for this process in the U.S. implementing regulations includes both an *examination* for knowledge and an *assessment* based on a *practical demonstration* as witnessed by a *designated examiner*.

Assessment conditions. The *assessment conditions* define the setting, tools, references, aids, and safety precautions that are in place at the time that a candidate's proficiency is assessed.

Assessment objective. A critical requirement of job performance that can be measured and assessed. Assessment objectives include skills and knowledge required by the job. A complete *assessment objective* description includes the required mariner performance, the conditions of assessment, and the standards of performance for successful accomplishment of the objective.

Assessment procedures. The activities that are conducted in administering the assessment of a candidate's proficiency. The term *assessment procedure* can be used to describe either the actions taken or the written instructions and activity descriptions that are carried out in conducting an assessment.

Designated examiner. A person who has been trained or instructed in techniques of training or *assessment* and is otherwise qualified to administer performance assessment procedures, in accordance with USCG requirements. Further details on the qualifications of *designated examiner* can be found in NVIC 6-97.

Instrumented measure. A performance measure that relies upon apparatus that can be calibrated to yield highly consistent and accurate measurement results.

Job. A post of employment consisting of a cluster of related work responsibilities and duties (e.g., chief engineer, third mate, able-bodied seaman). In the *STCW Code*, a job is further defined on the basis of licensure level (e.g., officer in charge of a navigational watch on ships of 500 gross tonnage or more).

Knowledge. The learned concepts, cues, facts, rules, and procedures that are necessary for proficient performance of a task (e.g., knowledge of algebra, knowledge of the Navigation Rules, knowledge of procedures for starting the main engine).

Observational measure. A performance measure that relies primarily upon an assessor's observation and interpretation of mariner performance to determine the assessment outcome.

Performance measure. The procedures used by the assessor in observing and recording mariner actions, or the outcome of those actions. The effectiveness of the assessment depends on the care with which these procedures are developed and followed.

Performance standard. The acceptable or target level established for individual *performance*

measures. The assessor must interpret observed performance as passing or failing the established standard.

Proficiency. An individual's demonstrated ability to meet selected job performance requirements, as established on the basis of *performance measures*, *performance standards*, and *proficiency criteria*.

Proficiency criteria. A rule established for combining the measures and standards for individual actions and providing a result for the larger unit of performance encompassed by the assessment objective. Proficiency criteria can be pass/fail to critical actions or graded for non-critical actions.

Qualified instructor. According to the United States implementing regulations, "the person who has been trained or instructed in instructional techniques and is otherwise qualified to provide required training to candidates for licenses, documents, or endorsements." Further details on the qualifications of *qualified instructors* can be found in NVIC 6-97.

Reliability. The *consistency* of a measurement procedure. In the context of assessment, reliability generally can be defined as the consistency of the assessment outcome when applied under comparable conditions. The reliability of an assessment establishes the maximum level of possible assessment *validity*. That is, an assessment can not be any more valid than it is reliable.

Scoring procedure. The defined procedures for combining individual *performance measures* and *performance standards* in the application of *proficiency criteria*.

Skills and abilities. The behaviors that must be applied in successful performance (e.g., typing skills, equipment fault-finding skills, navigation skills, shiphandling skills). Measurable and observable skills are those of interest in proficiency assessment.

Task. A single, observable work assignment that is independent of other actions and results in a valuable outcome. A task must be observable, be a complete work assignment, have a specific beginning and end, and be able to be measured by its intended product or outcome.

Validity. In the context of assessment, validity can be defined as the degree to which an assessment accurately reflects the skill, knowledge, and performance requirements of the job. The maximum validity of an assessment is established on the basis of its *reliability*. That is, an assessment can not be any more valid than it is reliable.

REFERENCES

46 CFR §10, 12, and 15. (1997). Implementation of the 1995 Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW). U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

Gagné, R., Briggs, L., & Wagner, W. (1992). Principles of instructional design (4th ed.). Fort Worth, Texas: Harcourt Brace College Publishers.

International Maritime Organization. (1996). International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 (STCW Convention). London: Author.

International Maritime Organization. (1996). Seafarers' training, certification, and watchkeeping (STCW) code. London: Author.

International Maritime Organization. (1998). Guidance on shipboard assessments of proficiency. Marine Safety Council Circular 853, 22 May, 1998. London: Author.

Jonassen, D., Hannum, W., & Tessmer, M. (1989). Handbook of task analysis procedures. New York: Praeger.

Krieger, G. (1994). Constructing and validating tests. In W. Tracey (ed.), Human Resources Management and Development Handbook (3rd ed.). New York: AMACOM.

McCallum, M.C., Barnes, A.E., Forsythe, A.M., & Smith, M.W. (2000). Conducting Mariner Assessments: A Trial Application of Procedures, Training and Manuals. (Report No. R&DC 204). Groton, CT: U.S. Coast Guard Research and Development Center In development.

McCallum, M. C., Forsythe, A. M., Smith, M. W., Nunnenkamp, J. M., & Sandberg, G. R. (1999). Developing performance-based assessments of mariner proficiency (Report No. R&DC 303). Groton, CT: U.S. Coast Guard Research and Development Center. In revision.

Mager, R. (1997). Preparing instructional objectives (3rd ed.). Atlanta, GA: Center for Effective Performance.

Murphy, J. (1997). Deck officer study guide, volume 1, deck general. Plympton, MA: Academy Publishing Company.

Rothwell, W. & Kazanas, H. (1998). Mastering the instructional design process (2nd ed.). San Francisco: Jossey-Bass.

Smith, M. W., Sandberg, G. R., McCallum, M. C., Stewart, R. D., Hard, D. A., Meurn, R. J., & Baker, D.R. (1996). An interactive test of mariner competence. (Report No. CG-D-04-97) Groton, CT: U.S. Coast Guard Research and Development Center. (NTIS AD-A 322240).

Sullivan, R. & Elenburg, M. (1988). Performance testing for technical trainers. Training and Development Journal. 42 (11), 38-40.

U.S. Coast Guard (1997). Navigation and Vessel Inspection Circular No. 4-97: Guidance on company roles and responsibilities under the 1995 Amendments of the International Convention on Standards of Training, Certification and Watchkeeping (COMDTPUB P16700.4 NVIC 4-97). Washington, DC: Author.

U.S. Coast Guard (1997). Navigation and Vessel Inspection Circular No. 6-97: Policy on qualified instructors and designated examiners who train or assess the competence of merchant mariners (COMDTPUB P16700.4 NVIC 6-97). Washington, DC: Author.

U.S. Coast Guard (1997). Navigation and Vessel Inspection Circular No. 7-97: Guidance on STCW quality standards systems (QSS) for merchant mariner courses or training programs (COMDTPUB P16700.4 NVIC 7-97). Washington, DC: Author.

U.S. Coast Guard, Department of Transportation (1990). Navigation Rules, International-Inland. (COMDTINST M16672.2B). Washington, DC: U.S. Government Printing Office.

[This page left blank intentionally.]

**Appendix A to
“A Method for Developing Mariner Assessments”**

**MARINER ASSESSMENT PROCEDURES FOR THE
PERFORMANCE OF LOOKOUT DUTIES**

This appendix contains example procedures for assessing a mariner's ability to perform *lookout duties*. The assessment package consists of assessor instructions, candidate instructions, seven assessment worksheets and an assessment control sheet for documenting the final results of the assessment.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

TABLE OF CONTENTS

Assessor Instructions.....	1
Candidate Instructions.....	5
Assessment Control Sheet.....	9
Assessment Worksheet I	11
Assessment Worksheet II.....	12
Assessment Worksheet III.....	14
Assessment Worksheet IV	16
Assessment Worksheet V.....	18
Assessment Worksheet VI	19
Assessment Worksheet VII.....	20
References	21

ASSESSOR INSTRUCTIONS

Introduction

The following procedures are designed for assessing a candidate's ability to perform lookout duties. The assessment includes demonstrating lookout techniques and making lookout reports in restricted visibility and in clear visibility during daylight and at night.

The assessment materials include Assessor Instructions, Candidate Instructions, an Assessment Control Sheet, and seven separate assessment modules (Assessment Worksheets I-VII). The Assessor Instructions describe the assessment objectives, method, performance measures, and performance standards. The Assessor Instructions also list the responsibilities of the assessor during each phase of the assessment process. The Candidate Instructions explain the assessment process from the candidate's perspective and define the responsibilities of the candidate.

The Assessment Control Sheet provides a record of the names of the candidate, assessor, and qualified instructor who certified that the candidate met the training prerequisites for assessment. The control sheet also includes the date and location of the assessment and the STCW reference information for the competency area being assessed. Section 3 of the Assessment Control Sheet provides space for the assessor to record the candidate's score on each assessment objective. Finally, section 4 of the control sheet summarizes the assessment objectives and the actions comprising each objective.

As the assessor, you will evaluate the candidate's ability to complete the assessment objectives correctly. Using the scoring procedures described below, you will provide the candidate with a separate score for each assessment objective and compile these scores into a final score for the entire lookout assessment. The scores for each assessment objective and the candidate's overall score for the entire assessment are to be recorded on the Assessment Control Sheet.

The rest of this section briefly describes the various components of this assessment. Assessment Worksheets I through VII provide additional information about the assessment objectives, method, conditions, performance measures and performance standards.

Assessment Objectives

During this assessment, the candidate should demonstrate his or her ability to:

1. Describe lookout duties and responsibilities.
2. Identify lookout stations and safe routes onboard.
3. Describe and identify the international distress signals.
4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.
5. Demonstrate lookout techniques and make lookout reports in clear visibility at night.
6. Demonstrate lookout techniques and make lookout reports in restricted visibility during daylight or at night.

7. Demonstrate the use of lookout equipment.
8. Demonstrate man overboard procedures.
9. Demonstrate lookout watch relief procedures.

Assessment Method

Although candidates can demonstrate their knowledge of the lookout duties in a written test, to ensure proficiency in the actual operating environment, candidates should undergo assessment either in a bridge simulator or onboard ship. This assessment package can be applied using either method.

Assessment Conditions

Candidates should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.

The conditions for Assessment Worksheets IV, V and VI are as follows:

- IV – Clear visibility during daylight.
- V – Clear visibility at night.
- VI – Restricted visibility during daylight or at night.

The conditions for the other assessment modules (worksheets I, II, III, and VII) can be any of the above.

Performance Measures and Standards

Each assessment objective is comprised of one or more actions. Each action has one or more corresponding performance measures and standards. For example, assessment objective 7 requires five different actions (see section 2 of *Assessment Worksheet V* on p. 16). Note that within one action there may be more than one performance measure. For example, in the case of action 7.3, the candidate has to pass both measures in order to pass the action. If a candidate fails one measure, he or she fails the action.

Note that if a candidate fails an assessment objective, he or she automatically fails the entire assessment. If this occurs, you should terminate the assessment without proceeding to the next objective.

Assessment Checklist

The following checklist summarizes the tasks and responsibilities of the assessor at each phase of the assessment process.

Preparing for the Lookout Assessment

- Gather Lookout assessment materials.
- Prepare the assessment area(s), test facility, and/or lookout station.
- Prepare and arrange for necessary lookout equipment; ensure that all equipment is operational.
- If you are using a simulator, check all exercise scenarios to ensure that they include all necessary assessment conditions.
- If you are conducting a shipboard assessment, ensure that objects are present for the candidate to observe and report.
- Identify and observe necessary safety precautions.
- Schedule assessment and inform all affected personnel.
- Review the *Assessment Control Sheet*, *Assessment Worksheets*, and *Candidate Instructions*.

Briefing the Candidate before the Assessment

- Provide the candidate with a copy of the *Candidate Instructions* and *Assessment Control Sheet*.
- Review the lookout assessment instructions with the candidate and answer any questions.
- Discuss the assessment objectives and explain any that require the use of non-standard procedures, such as the use of lookout reporting by degrees if the standard procedure onboard your vessel is by points.
- Explain the lookout assessment performance measures and standards.
- Advise the candidate of the time constraints, including when the assessment will begin and under what circumstances the assessment will be terminated.
- Inform the candidate that he or she should use appropriate marine terminology and nomenclature during all phases of the assessment.
- Discuss the desired outcome(s) and consequences of failing to perform part or all of the lookout assessment.
- Remind the candidate that it is permissible to ask questions during the assessment, especially if he or she has a safety concern.
- Inform the candidate that he or she must have vision correctable to at least 20/40 in each eye and uncorrected vision of at least 20/200 in each eye. His or her color sense must be determined to be satisfactory, without the use of color-sensing lenses.
- Inform the candidate that all phases of the assessment are to be conducted in English.
- Discuss the candidate's willingness to be assessed under the circumstances presented.

Observing the Candidate's Performance

- If a safety violation occurs, terminate the assessment immediately.
- Continuously observe the candidate during the assessment. Require that standard procedures or company policy be adhered to, except when assessment procedures require demonstration of knowledge or skill different from a convention adopted by the company (e.g., use of degrees to report sightings when points are the convention).
- Ensure realistic assessment conditions consistent with a normal working environment for the lookout. Do not allow the candidate to "learn the test" by observing the performance of other assessment candidates.
- Avoid giving the candidate unsolicited assistance, but respond to appropriate questions and provide appropriate equipment when required.
- Remain objective and maintain positive control of the assessment process at all times.

Recording Results and Determining Assessment Outcome

- Record performance on the appropriate lookout assessment worksheet.
- Strictly adhere to the prescribed scoring procedure(s).
- Determine and document the outcome of the assessment, then transfer the final results to the *Assessment Control Sheet*.
- Attest to successful demonstration of tasks in the Training Record Book (TRB), if appropriate.

Debriefing the Candidate

- Debrief the candidate as soon as possible after the assessment.
- Provide the candidate with a copy of the *Assessment Control Sheet*.
- Restate the assessment objectives.
- Focus on positive accomplishments first.
- Identify areas needing improvement.
- If the candidate failed to demonstrate proficiency, jointly develop an improvement plan to prepare for reassessment.

CANDIDATE INSTRUCTIONS

In this assessment, you will be evaluated on your ability to perform **lookout** duties. Table 1 shows the 1995 *STCW Code* specification for the performance of lookout duties.

Table 1. *STCW Code* specification for the performance of lookout duties.

STCW Requirement	1995 <i>STCW Code</i> , Section A-II/4 (p. 68): Mandatory minimum requirements for certification of ratings forming part of a navigational watch.
STCW Function	Navigation at the support level.
STCW Competence	Keep a proper lookout by sight and hearing.
STCW Proficiency	Responsibilities of a lookout, including reporting the approximate bearing of a sound signal, light or other object in degrees or points.

Assessment Objectives and Method

Your assessment will occur either onboard ship while underway or in a bridge simulator. A qualified assessor will assess you on your ability to meet the nine assessment objectives in the first column of Table 2. Note that each assessment objective has a corresponding assessment method. Performance measured by “oral or written questions” means your assessor will ask you questions pertinent to the objective and assess your ability to respond correctly to each question. Performance measured by “demonstration” means your assessor will ask you to demonstrate your ability to perform the actions required in the objective.

Table 2. Assessment objectives for lookout duties.

Assessment Objective	Assessment Type
1. Describe lookout duties and responsibilities	Oral or written questions
2. Identify lookout stations and safe routes on board	Oral or written questions
3. Describe and identify the international distress signals	Oral or written questions
4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight	Practical demonstration
5. Demonstrate lookout techniques and make lookout reports in clear visibility at night	Practical demonstration
6. Demonstrate lookout techniques and make lookout reports in restricted visibility during daylight or at night	Practical demonstration
7. Demonstrate the use of lookout equipment	Practical demonstration
8. Demonstrate man overboard procedures	Practical demonstration
9. Demonstrate lookout watch relief procedures	Practical demonstration

Refer to section 4 of the *Assessment Control Sheet* for a list of the specific actions required for each objective (you should receive a copy of this document from your assessor during your pre-assessment briefing). Below are some general guidelines for what you should expect during the assessment process.

Pre-Assessment Briefing with Assessor

Your pre-assessment briefing should occur approximately a week in advance of the scheduled assessment, if possible. [Note: This may not be practical or feasible for many of the trial implementations conducted for research purposes.] This will help you and the assessor to be well prepared for the assessment when it actually occurs. During this briefing, you should:

- Discuss your prior experience, training, and/or company policy with the assessor. On the basis of these qualifications, discuss whether you are qualified to undertake the lookout assessment. If you both agree you are qualified, then continue with the assessment process. If not, arrange for additional on-the-job or simulator training, and set a date for another review of your qualifications.
- Obtain a copy of the *Assessment Control Sheet* from your assessor. Review it and discuss the scope and depth of knowledge covered by the Lookout assessment. Ask questions about any part of the assessment that is unclear.
- Review the Lookout assessment performance measures and standards, and ask any questions you have about them.
- Discuss the desired outcome(s) and the consequences of failing to perform any part of the Lookout assessment.
- Discuss the general Lookout assessment procedures. Your assessor will inform you of how much time is allowed, when the assessment begins, and under what circumstances he or she will terminate the assessment.
- Discuss any non-standard procedures that are expected of you during the assessment. For example, on some ships, standard procedure is to report objects by use of bells or points, but during the lookout assessment you must also report objects using degrees.
- Consider whether you are willing to be assessed under the circumstances presented and advise the assessor of your willingness to undertake the assessment.

Participation in the Assessment

Your assessor will continuously observe you during the assessment. You are expected to adhere to standard procedures or company policy unless the assessor briefs you on a requirement to perform a non-standard procedure. During the assessment, remember to:

- Use appropriate marine terminology and nomenclature at all times.

- Listen to an entire question before responding or acting. Remember that you may not use reference material of any kind during the oral and written questions portion of the assessment.
- Ask questions if you have a safety concern. The assessor will provide you with appropriate responses to your questions. If a safety violation occurs, the assessor will terminate the assessment immediately.

Your assessor will ensure realistic assessment conditions consistent with the normal working environment for a lookout.

The Outcome of Your Assessment

The assessor will record your performance on a series of *Assessment Worksheets*. He or she will score each assessment objective on a “Pass/Fail” basis. Acceptable performance (a “Pass” score) will be based on your ability to correctly respond to examination questions. It will also be based on your ability to perform assigned tasks safely in a manner that demonstrates:

- The required level of skill, knowledge, and ability.
- Sound and professional judgment.

Unacceptable performance (a “Fail” score) will be based on your failure to perform a critical phase of the assessment exercise at an acceptable level of proficiency. When this occurs, your assessment will be suspended and postponed until you receive further instruction and training.

Note that the following events will terminate an assessment immediately:

- An action, or lack of action, by you which required corrective action or intervention by the assessor to prevent injury, damage, or the development of a hazardous condition.
- Your failure to use proper procedures, including appropriate communication procedures, during the assessment.
- Your failure to take prompt corrective action when required.

The assessor will strictly adhere to pre-determined scoring procedures, and will document the outcome of the assessment. He or she will transfer the final results of your assessment to the *Assessment Control Sheet*.

Assessment Debriefing

You and the assessor should discuss the assessment results as soon as possible after the assessment. During the debriefing:

- The assessor should provide you with a copy of the *Assessment Control Sheet* describing the results of your lookout assessment.
- The assessor should restate the assessment objective(s) and identify those that you successfully demonstrated.
- You and the assessor should discuss the areas in which you need improvement, and then develop an improvement plan based on the lookout assessment outcome(s).

Special Instructions for Lookout Assessments

- You must have vision correctable to at least 20/40 in each eye and uncorrected vision of at least 20/200 in each eye. Your color sense must be determined to be satisfactory, without the use of color sensing lenses (46 CFR 10.205).
- All phases of the lookout assessment are to be conducted in the English language.

ASSESSMENT CONTROL SHEET

Section 1. Assessment Reference Information

1. Name of Candidate	2. Name of Designated Assessor	3. Signature of Qualified Instructor ¹
4. Date of Assessment	5. Assessment Location ²	

Section 2. STCW Reference Information

Assessment Area	<i>Performance of lookout duties.</i>
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
STCW Requirement	1995 <i>STCW Code</i> , Section A-II/4, p. 68 – Mandatory minimum requirements for certification of ratings forming part of a navigational watch.
STCW Function	Navigation at the support level.
STCW Competence	Keep a proper lookout by sight and hearing.
STCW Proficiency	Responsibilities of a lookout, including reporting the approximate bearing of a sound signal, light or other object in degrees or points.

Section 3. Assessment Objectives, Types and Outcomes

Assessment Objective	Assessment Type	Assessment Outcome
1. Describe lookout duties and responsibilities.	Oral or written questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2. Identify lookout stations and safe routes.	Oral or written questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3. Describe and identify the international distress signals.	Oral or written questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.	Practical demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5. Demonstrate lookout techniques and make reports in clear visibility at night.	Practical demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6. Demonstrate lookout techniques and make lookout reports in restricted visibility during daylight or at night.	Practical demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7. Demonstrate the use of lookout equipment.	Practical demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8. Demonstrate man overboard procedures.	Practical demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9. Demonstrate lookout watch relief procedures.	Demonstration	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

¹ The qualified instructor certifies that the candidate has met the training prerequisites.

² Write the name of the simulator or vessel used and her location during the assessment (e.g., Massachusetts Maritime Academy training simulator; *S/R Long Beach* – Day 1 of Puget Sound to Valdez run, etc.).

Section 4. Assessment Worksheet Summary

Assessment Worksheet	Assessment Objective	Action
I	1. Describe lookout duties and responsibilities. 2. Identify lookout stations and safe routes on board. 3. Describe and identify the international distress signals.	1.1 Describe lookout duties and responsibilities. 2.1 Identify lookout stations on board. 2.2 Identify safe routes to and from lookout stations. 3.1 Describe and identify the international distress signals.
II	4. Demonstrate lookout techniques and make lookout reports <i>in clear visibility during daylight</i> .	4.1 List sightings that should be reported when detected. 4.2 Report sighted objects using the ship's bell. 4.3 Report sighted objects verbally using degrees. 4.4 Report sighted objects verbally using points. 4.5 Report sky objects verbally using points. 4.6 Report audible targets verbally using points.
III	5. Demonstrate lookout techniques and make lookout reports <i>in clear visibility at night</i> .	5.1 Report sighted objects using the ship's bell. 5.2 Report sighted objects verbally using degrees. 5.3 Report sighted objects verbally using points. 5.4 Report sky objects verbally using points. 5.5 Report audible targets verbally using points.
IV	6. Demonstrate lookout techniques and make lookout reports <i>in restricted visibility during daylight or at night</i> .	6.1 Report sighted objects using the ship's bell. 6.2 Report sighted objects verbally using degrees. 6.3 Report sighted objects verbally using points. 6.4 Report sky objects verbally using points. 6.5 Report audible targets verbally using points.
V	7. Demonstrate the use of lookout equipment.	7.1 Demonstrate the use of ship's bell. 7.2 Demonstrate the use of internal communications. 7.3 Demonstrate the use and care of binoculars. 7.4 Demonstrate the ability to take bearing using a bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. 7.5 List personal equipment for lookout.
VI	8. Demonstrate man overboard procedures.	8.1 Throw a ring life buoy to the man overboard. 8.2 Sound the alarm. 8.3 Keep the victim in sight at all times.
VII	9. Demonstrate lookout watch relief procedures.	9.1 Remain at your lookout station until you are properly relieved. 9.2 Do not allow anyone to relieve you until he or she has established night vision, or if for any reason you suspect that your relief is unable to carry out the duties of lookout. 9.3 Pass on information to your relief. 9.4 Call the bridge if you are not properly relieved.

ASSESSMENT WORKSHEET I

Section 1. Assessment Conditions

Assessment Objectives	1. <i>Describe lookout duties and responsibilities.</i> 2. <i>Identify lookout stations and safe routes onboard.</i> 3. <i>Describe and identify the international distress signals.</i>
Assessment Method	Oral or written questions.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	Examination proctor, test instrument, answers, and associated references.
Initial Condition	This assessment may be conducted either before or after the practical demonstration of lookout skills.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1.1 Describe lookout duties and responsibilities.	Answers question: <i>What are the duties and responsibilities of the lookout?</i>	Specifies that a lookout's duties are: sighting, identifying, and accurately reporting to the responsible authority all objects or sounds detected.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.1 Identify lookout stations on board.	Answers question: <i>Identify three common lookout stations on this vessel.</i>	Specifies: <input type="checkbox"/> Bridge. <input type="checkbox"/> Bridge wings. <input type="checkbox"/> Bow.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.2 Identify safe routes to and from lookout stations.	Answers question: <i>Identify the safe routes to the bow lookout station on this vessel.</i>	Identifies safe routes to and from bow lookout station.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.1 Identify and describe the international distress signals.	Answers question: <i>Describe and identify six international distress signals.</i>	Identifies and describes six of the following: <input type="checkbox"/> Red star shells. <input type="checkbox"/> Fog horn continuing sounding. <input type="checkbox"/> Flames on a vessel. <input type="checkbox"/> Gun fired at intervals of 1 minute. <input type="checkbox"/> Orange background black ball & square. <input type="checkbox"/> SOS. <input type="checkbox"/> "Mayday" by radio. <input type="checkbox"/> Parachute red flare. <input type="checkbox"/> Dye marker (any color). <input type="checkbox"/> Code flags November Charlie. <input type="checkbox"/> Square flag and ball. <input type="checkbox"/> Wave arms. <input type="checkbox"/> Radiotelephone alarm. <input type="checkbox"/> Position indicating radio beacon. <input type="checkbox"/> Smoke.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET II

Section 1. Assessment Conditions

Assessment Objective	4. Demonstrate lookout techniques and make lookout reports in clear visibility during daylight.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment should be conducted in clear visibility during daylight. The assessor should ensure there are reportable objects in sight.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
4.1 List the sightings that should be reported when detected.	Answers question: <i>Identify six of the sightings that should be reported when detected by the lookout.</i>	Correct response includes six of the following sightings: <input type="checkbox"/> Distress signals. <input type="checkbox"/> Persons in distress (man overboard, shipwrecked survivors, calls for help). <input type="checkbox"/> Vessels and/or aircraft in distress. <input type="checkbox"/> Derelicts, wreckage, floating or partially submerged debris. <input type="checkbox"/> Pollution incident (oil spill, a sheen on the water). <input type="checkbox"/> Vessel traffic and/or aircraft. <input type="checkbox"/> Aids to navigation (navigation buoys and lights). <input type="checkbox"/> Danger to the vessel or hazards to navigation (land, sighting or hearing breaking surf, obstructions, discoloration of the water). <input type="checkbox"/> Reduction in visibility due to fog, mist, falling snow, heavy rainstorms, sandstorms, or any other similar cause. <input type="checkbox"/> Change in weather. <input type="checkbox"/> Hearing other vessels or aids to navigation (bell, gong, fog horn, or maneuvering signals). <input type="checkbox"/> Ice. <input type="checkbox"/> Unusual sightings or any unreported change in the field of view or sector. <input type="checkbox"/> Sightings of marine life in compliance with the Endangered Species Act / Marine Mammal Protection Act (50 CFR 222), such as humpback or North Atlantic right whales, stellar sea lions, or sea turtles.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.2 Report sighted objects using the ship's bell.	Reports sighted objects using the ship's bell	Reports at least 3 surface objects using the ship's bell. Improper reporting constitutes failure. Failure to detect visible objects within in a specified sector of view constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2 – Actions, Performance Measures, Standards, and Scores (continued)

4.3 Report sighted objects verbally using degrees.	Reports sighted objects verbally using degrees	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects. <input type="checkbox"/> What (type) of objects. <input type="checkbox"/> Where (bearings, relative or true). Reports must be within 22-1/2° of the actual bearing of detected targets <input type="checkbox"/> How far-off (hull-down, on the horizon, hull-up, close aboard). <p>Failure of any of the above four standards constitutes failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.4 Report sighted objects verbally using points.	Reports sighted objects verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects. <input type="checkbox"/> What (type of objects). <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <input type="checkbox"/> How far-off (hull-down, on the horizon, hull-up, close aboard). <p>Failure of any of the above four standards constitutes failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.5 Report sky objects verbally using points. ³	Reports sighted objects verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 sky objects. Reports all visible objects. <input type="checkbox"/> What (type of objects). <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <p>Failure of any of the above three standards constitutes failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.6 Report audible target verbally using points. ³	Reports audible target verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 audible targets. Reports all audible objects. <input type="checkbox"/> What (type of objects). <input type="checkbox"/> Where (bearings, relative or true). <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <p>Failure of any of the above three standards constitutes failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:			FINAL SCORE <input type="checkbox"/> Pass <input type="checkbox"/> Fail

³ Successful completion of this action in any condition of visibility satisfies requirement.

ASSESSMENT WORKSHEET III

Section 1. Assessment Conditions

Assessment Objective	5. Demonstrate lookout techniques and make lookout reports in clear visibility at night.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment should be conducted in clear visibility at night. The assessor should ensure there are reportable objects in sight.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
5.1 Report sighted objects using the ship's bell.	Reports sighted objects using the ship's bell	Reports at least 3 surface objects using the ship's bell. Failure to detect visible objects within in a specified sector of view constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.2 Report sighted objects verbally using degrees.	Reports sighted objects verbally using degrees	<input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within 22-1/2° of the actual bearing of detected targets. <input type="checkbox"/> How far-off (hull-down, on the horizon, hull-up, close aboard). Failure of any of the above four standards constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.3 Report sighted objects verbally using points.	Reports sighted objects verbally using points	<input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects. <input type="checkbox"/> What (type of objects). <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <input type="checkbox"/> How far (hull-down, on the horizon, hull-up, close aboard). Failure of any of the above four standards constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

5.4 Report sky objects verbally using points. ⁴	Reports sighted objects verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <input type="checkbox"/> How far (hull-down, on the horizon, hull-up, close aboard). <p>Failure of any of the above three standards constitutes failure..</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.5 Report audible target verbally using points.	Reports audible target verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 audible targets. Reports all audible objects. <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <p>Failure of any of the above three standards constitute failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

⁴ Successful completion of this action in any condition of visibility satisfies requirement.

ASSESSMENT WORKSHEET IV

Section 1. Assessment Conditions

Assessment Objective	6. Demonstrate lookout techniques and make lookout reports in restricted visibility.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment should be conducted in restricted visibility during daylight or at night. The assessor should ensure there are reportable objects in sight.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
6.1 Report sighted objects using the ship's bell.	Reports sighted objects using the ship's bell	Reports at least 3 surface objects using the ship's bell. Failure to detect visible objects within in a specified sector of view constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.2 Report sighted objects verbally using degrees.	Reports sighted objects verbally using degrees	<input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within 22-1/2° of the actual bearing of detected targets. <input type="checkbox"/> How far (hull-down, on the horizon, hull-up, close aboard). Failure of any of the above four standards constitute failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.3 Report sighted objects verbally using points.	Reports sighted objects verbally using points	<input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects. <input type="checkbox"/> What (type of objects). <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <input type="checkbox"/> How far (hull-down, on the horizon, hull-up, close aboard). Failure of any of the above four standards constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.4 Report sky objects verbally using points. ⁵	Reports sighted objects verbally using points	<input type="checkbox"/> Verbally reports at least 3 surface objects. Reports all visible objects. <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. Failure of any of the above three standards constitutes failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

⁵ Successful completion of this action in any condition of visibility satisfies requirement.

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

6.5 Report audible targets verbally using points. ⁶	Reports audible targets verbally using points	<ul style="list-style-type: none"> <input type="checkbox"/> Verbally reports at least 3 audible targets. Reports all audible objects. <input type="checkbox"/> What (type of objects) <input type="checkbox"/> Where (bearings, relative or true). Reports must be within ± 2 points of the actual bearing of detected targets. <p>Failure of any of the above three standards constitutes failure.</p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

⁶ Successful completion of this action in any condition of visibility satisfies requirement.

ASSESSMENT WORKSHEET V

Section 1. Assessment Conditions

Assessment Objective	7. Demonstrate the use of lookout equipment.
Assessment Method	Practical skill demonstration, shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment may be conducted in any condition of visibility. It is essential that reportable objects be in sight.

Section 2. Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
7.1 Demonstrate the use of ship's bell.	Reports sighted objects using the ship's bell.	Satisfied by item 3.2 (Reporting sighted objects using the ship's bell).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.2 Demonstrate the use of internal communications (sound-powered telephone, walkie-talkie, etc.).	Reports sighted objects verbally.	Satisfied by items 3.3 (Reporting sighted objects verbally using degrees on the sound-powered telephone); 3.4 (Reporting sighted objects verbally using points on the sound-powered telephone); and 3.5 (Reporting audible target verbally using points on the sound-powered telephone).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.3 Demonstrate the use, care and focusing of binoculars.	Detects visual targets using binoculars. Describes care and use of binoculars.	<input type="checkbox"/> Demonstrates focus by identifying far object requiring use of binoculars. <input type="checkbox"/> Demonstrates systematic scanning technique. <input type="checkbox"/> Identifies correct stowage procedures.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.4 Demonstrate the ability to take bearing using a bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus.	Observes bearing using a bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus.	Sighted objects are observed within $\pm 3^\circ$ of the actual bearing.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.5 List personal equipment for lookout (flash light, sun glasses, foul weather gear, etc.).	Answers question: <i>Identify the personal equipment you should bring with you when you perform lookout.</i>	At a minimum, correct response includes: <input type="checkbox"/> Flashlight. <input type="checkbox"/> Sunglasses. <input type="checkbox"/> Foul weather gear. <input type="checkbox"/> Hat.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET VI

Section 1. Assessment Conditions

Assessment Objective	8. Demonstrate man overboard procedures.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment may be conducted in any condition of visibility. It is essential that reportable objects be in sight. The designated assessor simulates man overboard to starboard or port.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
8.1 Throw a ring life buoy to the man overboard.	Throws ring life buoy.	<input type="checkbox"/> Releases ring life buoy immediately. <input type="checkbox"/> Throws it over the person in the water so that he/she can grab the floating line first. <input type="checkbox"/> Exercises caution not to strike the person with the ring life buoy.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8.2 Sound the alarm.	Reports man overboard to the bridge.	<input type="checkbox"/> Immediately shouts "Man overboard-Man, overboard-Man overboard to starboard (or port)." <input type="checkbox"/> Indicates the side on which the person fell over in order to assist the bridge watch in determining the proper avoidance action.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8.3 Keep the victim in sight at all times.	Points at the victim.	<input type="checkbox"/> Establishes and maintains visual contact. <input type="checkbox"/> Points in the direction of the person in the water. <input type="checkbox"/> Remains on station until he or she is properly relieved or ordered otherwise.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET VII

Section 1. Assessment Conditions

Assessment Objective	9. Demonstrate the lookout watch relief procedure.
Assessment Method	Practical skill demonstration, shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at a lookout station equipped with an internal communications system, ship's bell, 7x50 individual eye focus binoculars, and bearing repeater fitted with a bearing/azimuth circle, alidade, or pelorus. The lookout station should be clear and the assessor must be able to observe activities.
Initial Conditions	The assessment may be conducted in any condition of visibility. It is essential that reportable objects are in sight.

Section 2. Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
9.1 Remain at your lookout station until you are properly relieved.	Answers question: <i>When can a lookout leave his or her station before being relieved?</i>	Correct response is <i>never</i> .	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.2 Do not allow anyone to relieve you until they have established their night vision or if for any reason, you suspect that your relief is unable to carry out the duties of lookout.	Answers question: <i>When being relieved during darkness, what is an important consideration before handing over the watch to your relief?</i>	Correct response is that the lookout should ensure that his or her relief has established night vision before handing over the watch.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.3 Pass on information to your relief.	Answers question: <i>What items of information constitute an adequate watch relief report?</i>	Correct response includes all of these items: <input type="checkbox"/> The location of any object(s) in sight. <input type="checkbox"/> Object(s) previously reported. <input type="checkbox"/> The present and past weather. <input type="checkbox"/> Any special instructions or safety precautions. <input type="checkbox"/> Brief description of your watch activities. <input type="checkbox"/> The status of the navigation lights.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.4 Call the bridge if you are not properly relieved.	Answers question: <i>What action do you take if you are not properly relieved?</i>	Correct response is to report to bridge that no relief has arrived.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

REFERENCES

46 CFR §97.275. (1997). U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

Hayler, W., Keever, J., & Seiler, P. (1980). American merchants seaman's manual (6th ed.). Centreville, MD: Cornell Maritime Press.

International Maritime Organization. (1996). Seafarers' training, certification, and watchkeeping code (STCW Code). London: Author.

Murphy, J. (1998). T.S. Patriot State vessel particulars, standing orders, bridge procedures, and directions for keeping the deck logbook (version MMA PSBD 001-1998). Buzzards Bay, MA: Massachusetts Maritime Academy.

Murphy, J. (1997). Deck officer study guide, volume 1, deck general. Plympton, MA: Academy Publishing Company.

U.S. Coast Guard, Department of Transportation. (1990). Navigation rules, international-inland (COMDTINST M16672.2B). Washington, DC: U.S. Government Printing Office.

U.S. Navy, Department of Defense. (1997). Personnel qualification standard (PQS). Washington, DC: U.S. Government Printing Office.

U.S. Navy, Department of Defense. (1991). Lookout training handbook (NAVEDTRA 12968). Washington, DC: U.S. Government Printing Office.

[This page left blank intentionally.]

**Appendix B to
“A Method for Developing Mariner Assessments”**

**MARINER ASSESSMENT PROCEDURES FOR THE
PERFORMANCE OF HELMSMAN DUTIES**

This appendix contains example procedures for assessing a mariner's ability to perform *helmsman duties*. The assessment package consists of the following: assessor instructions, candidate instructions, five assessment worksheets, and an assessment control sheet for documenting the final results of the assessment.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

TABLE OF CONTENTS

Assessor Instructions.....	1
Candidate Instructions.....	5
Assessment Control Sheet.....	9
Assessment Worksheet I	12
Assessment Worksheet II.....	14
Assessment Worksheet III.....	15
Assessment Worksheet IV	16
Assessment Worksheet V.....	18
References	19

ASSESSOR INSTRUCTIONS

Introduction

The following procedures are designed for assessing a candidate's ability to perform helmsman duties. The assessment includes demonstrating the use of all steering and compass equipment; performing steering procedures in open waters; and performing steering procedures in shallow water while maneuvering. It also includes demonstration of steering by visual range or landmark.

The assessment materials include *Assessor Instructions*, *Candidate Instructions*, an *Assessment Control Sheet*, and five separate assessment modules (*Assessment Worksheets I-V*). The *Assessor Instructions* describe the assessment objectives, method, performance measures, and performance standards. The *Assessor Instructions* also list the responsibilities of the assessor during each phase of the assessment process. The *Candidate Instructions* explain the assessment process from the candidate's perspective and define the responsibilities of the candidate.

The *Assessment Control Sheet* provides a record of the names of the candidate, assessor, and qualified instructor who certified that the candidate met the training prerequisites for assessment. The control sheet also includes the date and location of the assessment and the STCW reference information for the competency area being assessed. Section 3 of the *Assessment Control Sheet* provides space for the assessor to record the candidate's score on each assessment objective. Finally, section 4 of the control sheet summarizes the assessment objectives and the actions comprising each objective.

As the assessor, you will evaluate the candidate's ability to complete the assessment objectives correctly. Using the scoring procedures described below, you will provide the candidate with a separate score for each assessment objective and compile these scores into a final score for the entire assessment. The scores for each assessment objective and the candidate's overall score for the entire assessment are to be recorded on the *Assessment Control Sheet*.

The rest of this section briefly describes the various components of this assessment. *Assessment Worksheets I* through *V* provide additional information about the assessment objectives, method, conditions, performance measures, and performance standards.

Assessment Objectives

During this assessment, the candidate should demonstrate the following abilities:

1. Use steering equipment.
2. Use magnetic and gyrocompasses and visual range.
3. Understand and execute helm orders in open waters at sea speed.
4. Perform steering procedures in open waters at sea speed.
5. Understand and execute helm orders in shallow water while maneuvering.

6. Perform steering procedures in shallow water while maneuvering.
7. Understand and execute helm orders while steering by visual range or landmark.
8. Perform steering procedures while steering by visual range or landmark.
9. Perform steering duty changeover.
10. Perform helm relief procedures.
11. Perform helmsman steering failure procedures in open waters at reduced speed.

Assessment Method

Although candidates can demonstrate their knowledge of the helmsman duties in a written test, to ensure proficiency in the actual operating environment, they should undergo assessment requiring practical demonstration either in a bridge simulator or onboard ship. This assessment package can be applied using either method

Assessment Conditions

The assessment should occur at an approved steering station that is fitted with manual and automatic helm modes, gyro repeater, and magnetic compass. Optimally, the steering system should have manual and automatic pilot, non-follow-up unit, navigation modes with adjustable controls, rate of turn indicator, and steering alarms. As noted above, four different conditions are required for this assessment: open waters at sea speed, shallow waters while maneuvering, open waters at reduced speed, and steering by visual range or landmark.

Performance Measures and Standards

Each assessment objective is comprised of one or more actions. Each action has one or more corresponding performance measures and standards. For example, assessment objective 10 requires two different actions (see section 2 of *Assessment Worksheet IV* on p. 15). Note that within one action there may be more than one performance measure. For example, in the case of action 10.1, the candidate has to pass both performance measures in order to pass the action. If a candidate fails one measure, he or she fails the action.

Note that, if a candidate fails an assessment objective, he or she automatically fails the entire assessment. If this occurs, you should terminate the assessment.

Assessment Checklist

The following checklist summarizes the tasks and responsibilities of the assessor at each phase of the assessment process.

Preparing for the Steering Assessment

- Gather steering assessment materials.
- Prepare the assessment area(s), test facility, and/or bridge.

- Prepare and arrange for necessary steering equipment, and ensure that all equipment is operational.
- Review the *Assessment Control Sheet*, *Assessment Worksheets*, and *Candidate Instructions*.
- If you are using a simulator, check all exercise scenarios to ensure they include the required assessment conditions:
 - Open waters at sea speed (*Assessment Worksheet I*).
 - Shallow water while maneuvering (*Assessment Worksheet II*).
 - Steering by visual range or landmark (*Assessment Worksheet III*).
 - Any of the above (*Assessment Worksheet IV*).
 - Open waters at reduced speed (*Assessment Worksheet V*).
- If you are conducting a shipboard assessment, ensure that the appropriate conditions are present for each *Assessment Worksheet* and that the vessel is clear of navigational hazards. A steering failure drill may be simulated to fulfill the conditions required for *Assessment Worksheet V*.
- Identify and observe necessary safety precautions.
- Schedule assessment and inform all affected personnel.

Briefing the Candidate before the Assessment

- Provide the candidate with a copy of the *Candidate Instructions* and *Assessment Control Sheet*.
- Review the steering assessment instructions with the candidate and answer any questions.
- Discuss the assessment objectives and explain any that require the use of non-standard procedures.
- Explain the steering assessment performance measures and standards.
- Advise the candidate of the time constraints, including when the assessment will begin and under what circumstances the assessment will be terminated.
- Inform the candidate that he or she should use appropriate marine terminology and nomenclature during all phases of the assessment.
- Discuss the desired outcome(s) and consequences of failing to perform part or all of the steering assessment.
- Remind the candidate that it is permissible to ask questions during the assessment, especially if he or she has a safety concern.
- Inform the candidate that all phases of the assessment are to be conducted in English.
- Discuss the candidate's willingness to be assessed under the circumstances presented.

Observing the Candidate's Performance

- If a safety violation occurs, terminate the assessment immediately.
- Continuously observe the candidate during the assessment. Require that standard procedures or company policy be adhered to, except when assessment procedures require demonstration of knowledge or skill different from a convention adopted by the company.
- Give the candidate at least five helm commands during a 30-minute period on the helm.
- Ensure realistic assessment conditions consistent with a normal working environment for the helmsman. Ensure that the candidate can concentrate on the task at hand. Do not allow other crew members to interfere with the assessment. Do not allow the candidate to "learn the test" by observing the performance of other assessment candidates.
- Avoid giving the candidate unsolicited assistance, but respond to appropriate questions and provide appropriate equipment when required.
- Remain objective and maintain positive control of the assessment process at all times.

Recording Results and Determining Assessment Outcome

- Record performance on the appropriate steering assessment worksheet.
- The steering standards specified on each *Assessment Worksheet* may be modified to compensate for the area of navigation and prevailing sea state, but otherwise strictly adhere to the prescribed scoring procedure(s).
- Determine and document the outcome of the assessment, then transfer the final results to the *Assessment Control Sheet*.
- Attest to successful demonstration of tasks in the Training Record Book (TRB), if appropriate.

Debriefing the Candidate

- Debrief the candidate as soon as possible after the assessment.
- Provide the candidate with a copy of the *Assessment Control Sheet*.
- Restate the assessment objectives.
- Focus on positive accomplishments first.
- Identify areas needing improvement.
- If the candidate failed to demonstrate proficiency, jointly develop an improvement plan to prepare for reassessment.

CANDIDATE INSTRUCTIONS

In this assessment, you will be evaluated on your ability to perform helmsman duties. Table 1 shows the 1995 *STCW Code* specification for the performance of helmsman duties.

Table 1. *STCW Code* specification for the performance of helmsman duties.

STCW Requirement	1995 <i>STCW Code</i> , Section A-II/4 (p. 68): Mandatory minimum requirements for certification of ratings forming part of a navigational watch.
STCW Function	Navigation at the support level.
STCW Competence	Steer the ship and comply with helm orders also in the English language.
STCW Proficiency	Performance of helmsman duties.

Assessment Objectives and Methods

A qualified assessor will assess you on your ability to meet the 11 assessment objectives in the first column of Table 2. Note that each assessment objective has a corresponding assessment method(s). Performance assessed by “practical skill demonstration” means your assessor will ask you to demonstrate your ability to perform the actions required in the objective.

Performance assessed by “oral or written test questions” means your assessor will ask you to respond to one or more questions. He or she will assess your ability to respond correctly to each question. Your practical skill demonstration will occur either onboard ship while underway or in a ship bridge simulator.

Table 2. Assessment objectives and methods for helmsman duties.

Assessment Objective	Assessment Method
1. Demonstrate use of steering equipment.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral or written test questions
2. Demonstrate the use of magnetic and gyrocompasses and visual range.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral or written test questions
3. Demonstrate understanding and execution of helm orders in open waters at sea speed.	Practical skill demonstration – shipboard and/or ship bridge simulator
4. Perform steering procedures in open waters at sea speed.	Practical skill demonstration – shipboard and/or ship bridge simulator
5. Demonstrate understanding and execution of helm orders in shallow water while maneuvering.	Practical skill demonstration – shipboard and/or ship bridge simulator
6. Perform steering procedures in shallow water while maneuvering.	Practical skill demonstration – shipboard and/or ship bridge simulator

Assessment Objective	Assessment Method
7. Demonstrate understanding and execution of helm orders while steering by visual range or landmark.	Practical skill demonstration – shipboard and/or ship bridge simulator
8. Perform steering procedures while steering by visual range or landmark.	Practical skill demonstration – shipboard and/or ship bridge simulator
9. Demonstrate steering duty changeover.	Practical skill demonstration – shipboard and/or ship bridge simulator
10. Perform helm relief procedures.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral or written test questions
11. Demonstrate helmsman steering failure procedures.	Practical skill demonstration – shipboard and/or ship bridge simulator

Refer to section 4 of the *Assessment Control Sheet* for a list of the specific actions required for each objective (you should receive a copy of this document from the assessor during your pre-assessment briefing). Below are some general guidelines for what you should expect during the assessment process.

Pre-Assessment Briefing with Assessor

This briefing should occur approximately a week in advance of the scheduled assessment, if possible. This will help you and the assessor to be well prepared for the assessment when it actually occurs. During this briefing, you should:

- Discuss your prior experience, training, and/or company policy with the assessor. On the basis of these qualifications, discuss whether you are qualified to undertake the helmsman assessment. If you both agree you are qualified, then continue with the assessment process. If not, arrange for additional on-the-job or simulator training, and set a date for another review of your qualifications.
- Obtain a copy of the *Assessment Control Sheet* from your assessor. Review it and discuss the scope and depth of knowledge covered by the helmsman assessment. Note that the assessment is to be conducted in the English language. Ask questions about any part of the assessment that is unclear.
- Review the helmsman assessment performance measures and standards, and ask any questions you have about them.
- Discuss the desired outcome(s) and the consequences of failing to perform any part of the helmsman assessment.
- Discuss the general helmsman assessment procedures. Your assessor will inform you of how much time is allowed, when the assessment begins, and under what circumstances he or she will terminate the assessment.

- Discuss any non-standard procedures that are expected of you during the assessment.
- Consider whether you are willing to be assessed under the circumstances presented and advise the assessor of your willingness to undertake the assessment.

Participation in the Assessment

Your assessor will continuously observe you during the assessment. You are expected to adhere to standard procedures or company policy unless the assessor briefs you on a requirement to perform a non-standard procedure. During the assessment, remember to:

- Use appropriate marine terminology and nomenclature at all times.
- Listen to an entire question before responding or acting. Remember that you may not use reference material of any kind during the assessment examination.
- Ask questions if you have a safety concern. The assessor will provide you with appropriate responses to your questions. If a safety violation occurs, the assessor will terminate the assessment immediately.

Your assessor will ensure realistic assessment conditions consistent with the normal working environment for a helmsman.

The Outcome of Your Assessment

The assessor will record your performance on a series of *Assessment Worksheets*. The assessor will score each assessment objective on a “Pass/Fail” basis. Acceptable performance (a “Pass” score) will be based on your demonstrated ability to correctly respond to the questions that you are asked during the examination portions of the assessment. It will also be based on your ability to safely perform assigned tasks in a manner that demonstrates you possess the required level of skill, knowledge, and ability, as well as sound and professional judgment.

Unacceptable performance (a “Fail” score) will be based on your failure to perform a critical phase of the assessment exercise at an acceptable level of proficiency. When this occurs, your assessment will be suspended and postponed until you receive further instruction and training.

Note that the following events will terminate an assessment immediately:

- An action, or lack of action, by you which required corrective action or intervention by the assessor to prevent injury, damage, or the development of a hazardous condition.
- Your failure to use proper procedures, including appropriate communication procedures, during the assessment.
- Your failure to take prompt corrective action when required.

The assessor will strictly adhere to pre-determined scoring procedures, and will document the outcome of the assessment. He or she will transfer the final results of your assessment to the *Assessment Control Sheet*.

Assessment Debriefing

You and the assessor should discuss the assessment results as soon as possible after the assessment. During the debriefing:

- The assessor should provide you with a copy of the *Assessment Control Sheet* describing the results of your helmsman assessment.
- The assessor should restate the assessment objective(s) and identify those that you successfully demonstrated.
- If appropriate, you and the assessor should discuss the areas in which you need improvement, and then develop an improvement plan based on the helmsman assessment outcome(s).

ASSESSMENT CONTROL SHEET

Section 1. Assessment Reference Information

1. Name of Candidate	2. Name of Designated Assessor	3. Signature of Qualified Instructor ¹
4. Date of Assessment	5. Assessment Location ²	

Section 2. STCW Reference Information

Assessment Area	<i>Performance of helmsman duties.</i>
Assessment Method	Shipboard and/or ship bridge simulator assessment.
STCW Requirement	<i>STCW Code, Section A-II/4, p. 68 – Mandatory minimum requirements for certification of ratings forming part of a navigational watch.</i>
STCW Function	Navigation at the support level.
STCW Competence	Steer the ship and comply with helm orders also in the English language.
STCW Proficiency	Performance of helmsman duties.

Section 3. Assessment Objectives, Methods, and Scores

Assessment Objective	Assessment Methods	Score
1. Demonstrate use of steering equipment.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2. Demonstrate the use of magnetic, gyrocompasses and visual range.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3. Demonstrate understanding and execution of helm orders <i>in open waters at sea speed</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4. Perform steering procedures <i>in open waters at sea speed</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5. Demonstrate understanding and execution of helm orders <i>in shallow water while maneuvering</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6. Perform steering procedures <i>in shallow water while maneuvering</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7. Demonstrate understanding and execution of helm orders <i>while steering by visual range or landmark</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8. Perform steering procedures <i>while steering by visual range or landmark</i> .	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9. Demonstrate steering duty changeover.	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
10. Perform helm relief procedures.	Practical skill demonstration – shipboard and/or ship bridge simulator, oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
11. Demonstrate helmsman steering failure procedures.	Practical skill demonstration – shipboard and/or ship bridge simulator	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

¹ The qualified instructor certifies that the candidate has met the training prerequisites.

² Write the name of the simulator or vessel used and her location during the assessment

Section 4. Assessment Worksheet Summary

Assessment Worksheet	Assessment Objective	Action
I	<ol style="list-style-type: none"> 1. Demonstrate the use of steering equipment. 2. Demonstrate the use of magnetic and gyrocompasses and visual range. 3. Demonstrate understanding and execution of helm orders <i>in open waters at sea speed (water depth = 6 times draft or more)</i>. 4. Perform steering procedures <i>in open waters at sea speed</i>. 	<ol style="list-style-type: none"> 1.1 Use and adjustment of steering controls. 1.2 Use of the steering compass. 1.3 Use of the rudder angle indicator. 1.4 Use of the rate of turn indicator. 1.5 Use of steering system alarms. 1.6 Use and adjustment of the course recorder. 2.1 Compare and report course by gyro and magnetic after course change. 2.2 Compare and report course by gyro and magnetic at time interval specified by standing orders or company policy. 2.3 Report course by gyro and magnetic to the watch officer when changes in compared headings are noted. 3.1 Repeat helm command as given. 3.2 Execute course change. 3.3 Execute helm order. 3.4 Report helm order. 3.5 Report conflicts in commands. 4.1 Steer by gyrocompass. 4.2 Steer by magnetic compass. 4.3 Steer by visual range or landmark.
II	<ol style="list-style-type: none"> 5. Demonstrate understanding and execution of helm orders <i>in shallow water while maneuvering (water depth = 1.5 times draft or less)</i>. 6. Perform steering procedures <i>in shallow water while maneuvering</i>. 	<ol style="list-style-type: none"> 5.1 Repeat helm command as given. 5.2 Execute course change. 5.3 Execute helm order. 5.4 Report helm order. 5.5 Report command conflicts. 6.1 Steer by gyrocompass. 6.2 Steer by magnetic compass. 6.3 Steer by visual range or landmark.

Section 4. Assessment Worksheet Summary (continued)

III	7. Demonstrate understanding and execution of helm orders <i>while steering by visual range or landmark.</i> 8. Perform steering procedures <i>while steering by visual range or landmark.</i>	7.1 Repeat helm command as given. 7.2 Execute course change. 7.3 Execute helm order. 7.4 Report helm order. 7.5 Report command conflicts. 8.1 Steer by gyrocompass. 8.2 Steer by magnetic compass. 8.3 Steer by visual range or landmark.
IV	9. Demonstrate steering duty changeover. 10. Perform helm relief procedures.	9.1 Changeover steering pumps. 9.2 Changeover steering motors. 9.3 Engage/disengage autopilot. 9.4 Engage/disengage non-follow-up unit (NFU). 10.1 Hand over the helm. 10.2 Relieving the wheel during a maneuver.
V	11. Demonstrate helmsman steering failure procedures.	11.1 Respond to steering failure.

ASSESSMENT WORKSHEET I

Section 1. Assessment Conditions

Assessment Objectives	1. Demonstrate the use of steering equipment. 2. Demonstrate the use of magnetic and gyrocompasses and visual range. 3. Demonstrate understanding and execution of helm orders in open waters at sea speed (water depth = 6 times draft or more). 4. Perform steering procedures in open waters at sea speed.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at an approved steering station fitted with manual and automatic helm modes, gyro repeater, and magnetic compass. Optimally, the steering system should have manual and automatic pilot, non-follow-up unit, and navigation modes with adjustable controls, rate of turn indicator, and steering alarms.
Initial Condition	This assessment should occur <i>in open waters at sea speed</i> . Water depth must be at least six times vessel draft or more.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1.1 Use and adjustment of steering controls.	Ensures that heading is maintained	Operation of steering controls is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.2 Use of the steering compass.	Ensures that heading is maintained	Operation of steering compass is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.3 Use of the rudder angle indicator.	Ensures that heading is maintained	Operation of rudder angle indicator is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.4 Use of the rate of turn indicator.	Ensures that heading is maintained	Operation of rate of turn indicator is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.5 Use of steering system alarms.	Ensures that heading is maintained	Operation of steering system alarms is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.6 Use and adjustment of the course recorder.	Ensures that heading is maintained	Operation of course recorder is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.1 Compare and report course by gyro and magnetic after course change.	Report of compass comparison	Correct report after course change.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.2 Compare and report course by gyro and magnetic at time interval specified by stand orders or company policy.	Report of compass comparison	Correct report at the time interval specified in the standing orders or company policy not to exceed 15 minutes.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

Action	Performance Measure	Performance Standard	Score
2.3 Report course by gyro and magnetic to the watch officer when changes in compared headings are noted.	Report of compass comparison	Correct report when changes in compared headings are noted.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.1 Repeat helm command as given.	Repetition of steering order	Repeats helm command word-for-word using standard nomenclature and terminology in compliance with standing orders or company policy.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.2 Execute course change.	Execution of course change	Standard is to perform all of the following: <ul style="list-style-type: none"><input type="checkbox"/> Applies appropriate amount of rudder to actuate controllable turn rate.<input type="checkbox"/> Approaches ordered course, recognizes turn rate.<input type="checkbox"/> Checks swing, applies counter rudder as necessary.<input type="checkbox"/> Steadies up on ordered course.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.3 Report helm order.	Answers question: <i>What is the chain of command among the bridge team?</i>	Report as soon as the order and/or action has been completed.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.4 Understand procedure for conflicting commands.	Reports chain of command	States that the master's orders are to be obeyed whenever there is conflict between members of the bridge team.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.1 Steer by gyrocompass.	Ensures that heading is maintained	Maintains heading $\pm 3^\circ$.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.2 Steer by magnetic compass.	Ensures that heading is maintained	Maintains heading $\pm 5^\circ$.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.3 Steer by visual range or landmark.	Ensures that heading is maintained	Standard is to: <ul style="list-style-type: none"><input type="checkbox"/> Identify range.<input type="checkbox"/> Apply rudder to correct side.<input type="checkbox"/> Maintain forward and after range in a vertical line.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 3. Additional Assessor Guidance

- The assessor should give the candidate at least five helm commands during this part of the assessment.
- The specified steering standards may be modified to compensate for the area of navigation and prevailing sea state.

ASSESSMENT WORKSHEET II

Section 1. Assessment Conditions

Assessment Objectives	5. Demonstrate the use of magnetic and gyrocompasses and visual range in shallow water while maneuvering. 6. Perform steering procedures in shallow water while maneuvering.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at an approved steering station fitted with manual and automatic helm modes, gyro repeater, and magnetic compass. Optimally, the steering system should have manual and automatic pilot, non-follow-up unit, and navigation modes with adjustable controls, rate of turn indicator, and steering alarms.
Initial Condition	This assessment should occur in shallow water while maneuvering. Water depth must be no more than 1.5 times vessel draft.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
5.1 Repeat helm command as given.	Repeats steering order	Repeats helm command exactly using standard nomenclature and terminology in compliance with standing orders or company policy.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.2 Execute course change.	Executes course change	Standard is to: <ul style="list-style-type: none"><input type="checkbox"/> Apply appropriate amount of rudder to actuate controllable turn rate.<input type="checkbox"/> Approach ordered course, recognizes turn rate.<input type="checkbox"/> Check swing, apply counter rudder as necessary.<input type="checkbox"/> Steady up on ordered course.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.3 Report helm order.	Reports steering order	Complies with standard helm orders.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.4 Understand procedure for conflicting commands.	Reports of chain of command	States that the master's orders are to be obeyed whenever there is conflict between members of the bridge team.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.1 Steer by gyrocompass.	Ensures that heading is maintained	Maintains heading $\pm 2^\circ$.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.2 Steer by magnetic compass.	Ensures that heading is maintained	Maintains heading $\pm 3^\circ$.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
6.3 Steer by visual range or landmark.	Ensures that heading is maintained	Standard is to: <ul style="list-style-type: none"><input type="checkbox"/> Identify range.<input type="checkbox"/> Apply rudder to correct side.<input type="checkbox"/> Maintain forward and after range in a vertical line.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:	FINAL SCORE		<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET III

Section 1. Assessment Conditions

Assessment Objectives	7. Demonstrate understanding and execution of helm orders while steering by visual range or landmark. 8. Perform steering procedures while steering by visual range or landmark.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at an approved steering station fitted with manual and automatic helm modes, gyro repeater, and magnetic compass. The steering system should have manual and automatic pilot, non-follow-up unit, and navigation modes with adjustable controls, rate of turn indicator, and steering alarms.
Initial Condition	This assessment should occur in conditions requiring steering by visual range or landmark.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
7.1 Repeat helm command as given.	Repeats steering order	Repeats helm command exactly using standard nomenclature and terminology in compliance with standing orders or company policy.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.2 Execute course change.	Executes course change	<input type="checkbox"/> Applies appropriate amount of rudder to actuate controllable turn rate. <input type="checkbox"/> Approaches ordered course, recognizes turn rate. <input type="checkbox"/> Checks swing, applies counter rudder as necessary. <input type="checkbox"/> Steadies up on ordered course	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.3 Report helm order.	Reports steering order	Complies with standard helm orders.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
7.4 Understand procedure for conflicting commands.	Reports of chain of command	States that the master's orders are to be obeyed whenever there is conflict between members of the bridge team.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8.1 Steer by gyrocompass.	Ensures that heading is maintained	Maintains heading $\pm 3^\circ$ (open waters). Maintains heading $\pm 2^\circ$ (shallow water).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8.2 Steer by magnetic compass.	Ensures that heading is maintained	Maintains heading $\pm 5^\circ$ (open waters). Maintains heading $\pm 3^\circ$ (shallow water).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
8.3 Steer by visual range or landmark.	Ensures that heading is maintained	Standard is to : <input type="checkbox"/> Identify range. <input type="checkbox"/> Apply rudder to correct side. <input type="checkbox"/> Maintain forward and after range in a vertical line.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET IV

Section 1. Assessment Conditions

Assessment Objectives	9. Demonstrate steering duty changeover. 10. Perform helm relief procedures.
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment, oral test questions.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at an approved steering station fitted with manual and automatic helm modes, gyro repeater and magnetic compass. Optimally, the steering system should have a manual, automatic pilot, NFU, and navigation modes with adjustable controls, rate of turn indicator, and steering alarms.
Initial Condition	This assessment can be conducted in any of the following conditions: <ul style="list-style-type: none"> • Open waters at sea speed (water depth = 6 times draft or more). • Shallow water while maneuvering (water depth = 1.5 times draft or less). • Steering by visual range or landmark.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
9.1 Changeover steering pumps.	Ensures changeover of steering pumps	Changeover procedure is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.2 Changeover steering motors.	Ensures changeover of steering motors	Changeover procedure is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.3 Engage/ disengage autopilot.	Ensures that autopilot is engaged/disengaged	Changeover procedure is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
9.4 Engage/disengage non-follow-up unit.	Ensures that NFU is engaged/disengaged	Changeover procedure is consistent with manufacturer's recommendations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
10.1 Hand over the helm.	Answers question: <i>What should you report when handing over the helm to your relief, and to whom should you report this?</i> Answers question: <i>What position should the rudder be in when the helm is relieved?</i>	Correct report includes all of the following: <ul style="list-style-type: none"> □ The mode of operation [hand, autopilot, non-follow-up unit (NFU)]. □ Steering unit in use (port or starboard steering unit). □ Vessel's heading: <ul style="list-style-type: none"> • True course. • Gyro course. • Magnetic compass course. □ The amount of helm carried to maintain a steady course, when appropriate. Helmsman who has been relieved should report the above information to the officer of the navigational watch after being relieved. The helm should be relieved with no rudder. Ensure that the helmsman checks the course recorder chart at the completion of his or her trick on the wheel whether steering by hand, autopilot or non-follow-up unit (NFU).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

10.2 Relieving the wheel during a maneuver	Answers question: <i>Under what circumstances should the wheel be relieved during a maneuver?</i>	Correct response is <i>never</i> . Under no circumstances should the wheel be relieved during a maneuver.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET V

Section 1. Assessment Conditions

Assessment Objective	11. Demonstrate helmsman steering failure procedures.		
Assessment Method	Shipboard assessment and/or ship bridge simulator assessment.		
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards.		
Required Equipment, Apparatus, and/or Tools	The candidate should be posted at an approved steering station fitted with manual and automatic helm modes, gyro repeater, magnetic compass, optimally the steering system should have a manual, automatic pilot, NFU and navigation modes with adjustable controls, rate of turn indicator, and steering alarms.		
Initial Condition	This assessment should be conducted in open waters at reduced speed (water depth = 6 times draft or more). The vessel should be clear of navigational hazards. A steering failure drill may be simulated for purpose of this assessment. Standing orders or company policy must be strictly adhered to during the all phases of the assessment.		

Section 2. Action, Performance Measure, Standards, and Score

Action	Performance Measure	Performance Standard	Score
11.1 Respond to steering failure.	Responds to steering failure	<input type="checkbox"/> Helmsman reports steering failure to the officer of the navigational watch. <input type="checkbox"/> Alternative and/or emergency steering system is engaged.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

REFERENCES

46 CFR §35.40-35. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §58.25-35. (1997). Helm arrangements. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §78.47-57. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §97.275. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §108-643. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §131.850. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §196.37-35. (1997). Rudder orders. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

46 CFR §113.40-10. (1997). Rudder angle indicator systems. U.S. Code of Federal Regulations. Coast Guard, U.S. Department of Transportation. Washington, DC: Office of the Federal Register.

Hayler, W., Keever, J., & Seiler, P. (1980). American merchant seaman's manual (6th ed.). Centreville, MD: Cornell Maritime Press.

International Maritime Organization. (1996). Seafarers' training, certification, and watchkeeping code (STCW Code). London: Author

Murphy, J. (1998). T.S. Patriot State vessel particulars, standing orders, bridge procedures, and directions for keeping the deck logbook (Version MMA PSBD 001-1998). Buzzards Bay, MA: Massachusetts Maritime Academy.

Murphy, J. (1994). Deck officer study guide (vol. 1), deck general. Plympton, MA: Academy Publishing Company.

Sperry Marine, Inc. (1993). Adaptive digital gyropilot (ADG 6000) operations manual JA19-5567. New Jersey: Sperry Marine Corp.

U. S. Coast Guard, Department of Transportation. (1997). Navigation and vessel inspection circular: Guidance on Coast Guard accepted training record books (NVIC 5-97). Washington, DC: U.S. Government Printing Office.

U.S. Coast Guard, Department of Transportation. (1990). Navigation rules, international-inland (COMDTINST M16672.2B), Appendix A to Part 81-72 COLREGS. Washington, DC: U.S. Government Printing Office.

U.S. Navy, Department of Defense. (1997). Personnel qualification standard (PQS). Washington, DC: U.S. Government Printing Office.

**Appendix C to
“A Method for Developing Mariner Assessments”**

**MARINER ASSESSMENT PROCEDURES FOR PREPARING
THE MAIN ENGINE FOR OPERATION**

This appendix contains example procedures for assessing a mariner's ability to prepare the main engine for operation. The assessment package consists of the following: assessor instructions, candidate instructions, five assessment worksheets, and an assessment control sheet for documenting the final results of the assessment.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

TABLE OF CONTENTS

Assessor Instructions.....	1
Candidate Instructions.....	6
Assessment Control Sheet.....	10
Assessment Worksheet I	12
Assessment Worksheet II.....	14
Assessment Worksheet III.....	16
Assessment Worksheet IV	18
Assessment Worksheet V.....	19
References	20

ASSESSOR INSTRUCTIONS

Introduction

The following procedures are designed for assessing a candidate's ability to prepare the main engine of a ship for operation. This includes starting the main engine and preparing the control system. This package was specifically developed for a propulsion system that has two diesels driving one shaft through a reduction gear. The diesel engines described in the assessment procedures are reversible, medium speed engines. With some modification, this package may be applicable to propulsion plants with single, slow speed diesel engines.

The assessment materials include *Assessor Instructions*, *Candidate Instructions*, an *Assessment Control Sheet*, and five separate assessment modules (*Assessment Worksheets I-V*). The *Assessor Instructions* describe the assessment objectives, method, performance measures, and performance standards. The *Assessor Instructions* also list the responsibilities of the assessor during each phase of the assessment process. The *Candidate Instructions* explain the assessment process from the candidate's perspective and define the responsibilities of the candidate.

The *Assessment Control Sheet* provides a record of the names of the candidate, assessor, and qualified instructor who certified that the candidate met the training prerequisites for assessment. The control sheet also includes the date and location of the assessment and the STCW reference information for the competency area being assessed. Section 3 of the *Assessment Control Sheet* provides space for the assessor to record the candidate's score on each assessment objective. Finally, section 4 of the control sheet summarizes the assessment objectives and the actions comprising each objective.

As the assessor, you will evaluate the candidate's ability to complete the assessment objectives correctly. Using the scoring procedures described below, you will provide the candidate with a separate score for each assessment objective and compile these scores into a final score for the entire assessment. The scores for each assessment objective and the candidate's overall score for the entire assessment are to be recorded on the *Assessment Control Sheet*.

The rest of this section briefly describes the various components of this assessment. *Assessment Worksheets I* through *V* provide additional information about the assessment objectives, method, conditions, performance measures, performance standards, and scoring procedures.

Assessment Objectives

In a step-by-step procedure, the candidate should safely start the main engine. This includes the following steps:

1. Perform pre-start checks.
2. Roll over the main engine.
3. Start the engine ahead and astern.
4. Transfer control to a remote operating station.
5. Prepare the propulsion plant to answer bells.

Assessment Method

Although starting procedures can be practiced in a simulator and knowledge of procedures for starting the main engine can be evaluated by written examination, the final assessment for this proficiency should be conducted onboard a vessel. This ensures the candidate can perform the tasks in an actual work setting.

Assessment Conditions

This assessment should begin at the local engine control station. The candidate should then work throughout the engine room. As the assessor, you should tell the candidate each subsequent activity to complete, but not the individual actions necessary to complete the activity. The candidate will not receive any assistance from others, except to check pressure and temperature levels as required during the assessment. The conditions you can vary during the assessment are specified in the next section under “Preparing for the Assessment” and on the individual worksheets for each assessment objective.

Performance Measures and Standards

Each assessment objective is comprised of one or more actions. Each action has one or more corresponding performance measures and standards. For example, assessment objective 2 requires six different actions (see section 2 of *Assessment Worksheet II* on p. 15). Note that within one action, such as action 2.6, there may be more than one performance measure. In the case of action 2.6, the candidate has to pass both measures in order to pass the action. If the candidate fails one measure, he or she fails the action.

Use pass/fail scoring for each assessment objective:

- Pass** – The candidate’s total score was at or above the passing level noted at the bottom of each *Assessment Worksheet*. The candidate also correctly performed all “required” actions – that is, those that would result in an automatic failure if performed incorrectly. Required actions are noted in the “standards” column of each *Assessment Worksheet*.
- Fail** – The candidate either did not have a high enough score or did not properly complete all of the required items.

Note that, if a candidate fails an assessment objective, he or she automatically fails the entire assessment. If this occurs, you should terminate the assessment without proceeding to the next objective.

Individual measures and standards for each assessment objective are specified on *Assessment Worksheets I* through *V*.

Assessment Checklist

The following checklist summarizes the tasks and responsibilities of the assessor at each phase of the assessment process.

Preparing for the Assessment

- Inform the engineering watch officer, bridge watch officer, and candidate(s) of the date and time of the assessment.
- Obtain communication equipment for yourself and the candidate(s).
- Check the condition of each of the possible variables for each assessment objective. Then, set each variable to any level you desire, within a normal range. The intent is to set up the conditions so that a candidate must demonstrate knowledge of the main engine systems – not just memorize a series of steps. This also helps to vary the assessment from candidate to candidate. Here are the conditions you can vary before each assessment:

Assessment Objective 1

- Jacket water head tank level.
- Clutch air control-valve position.
- Cylinder air cock positions.
- Starting air supply to the engine.
- Emergency stop switch position.

Assessment Objective 2

- Power to the jacket water pump.
- Power to the lubricating oil pump.
- Presence of leak(s) in the jacket water system.
- Relief valve setting on the lubricating oil pump.

Assessment Objective 3

- Fuel oil pressure drop across the suction strainer.
- Fuel oil supply/return solenoid valve positions.

Assessment Objective 4

- Location of engine control (it can be at either a remote engineering station or the bridge station, but the engine should be in a local mode of operation before beginning the assessment of this objective).

Assessment Objective 5

- Settings on the automatic control (this is to test the candidates' knowledge of the control system).
- For all assessment objectives, ensure that the reduction gear, thrust bearings, and stern seal systems are set up properly.
- Determine the appropriate operating conditions for the ship's:
 - Lube oil temperature (e.g., normal starting range is 130-150° F).
 - Lube oil pressure.

- Starting air pressure.
- Jacket water temperature.
- Jacket water pump pressure.
- Fuel pump pressure.

□ Remember that this assessment should take place under normal conditions. If abnormal conditions arise, suspend the assessment and restart after you have corrected any abnormal conditions.

Briefing the Candidate before the Assessment

- This assessment should be conducted for two candidates at once – each candidate should be responsible for starting one of the main engines.
- Provide each candidate with a copy of the *Candidate Instructions and Assessment Control Sheet*.
- Review the starting main engine assessment instructions with the candidates and answer any questions.
- Explain the assessment performance measures and standards.
- Discuss the desired outcome(s) and consequences of failing to perform part of all of the assessment.
- Explain that the assessment will be terminated if:
 - The candidate does not correctly perform all of the required actions.
 - One or more of the initial equipment conditions become abnormal or unsafe.
 - The candidate violates vessel safety procedures.
- Remind the candidates that it is permissible to ask questions during the assessment, especially if they have a safety concern.
- Advise the candidates that they may have assistants to help with activities that take time such as opening the blow down valves. However, the candidates are responsible for directing the assistants' activities and verifying that the assistants' tasks have been carried out correctly.
- Ensure that the candidates have the proper equipment to carry out the assessment:
 - Small notebook and pencil for writing down conditions and readings.
 - Wrenches used for opening valves.
 - Long-sleeved shirt to prevent burning arms when reaching over hot pipes.
 - Pair of work gloves.
- Discuss the candidates' willingness to be assessed under the circumstances presented.

Observing the Candidate's Performance

- If a safety violation occurs, terminate the assessment immediately.
- Continuously observe the candidates during the assessment. Require that standard procedures or company policy be adhered to except when assessment procedures require demonstration of knowledge or skill different from a convention adopted by the company or facility.
- Ensure realistic assessment conditions consistent with a normal working environment for a marine engineer. Ensure the candidates can concentrate on the task at hand.
- Avoid giving the candidates unsolicited assistance, but respond to appropriate questions and provide appropriate equipment when required.
- Remain objective and maintain positive control of the operation at all times.

Determining Assessment Outcome

- Record performance on the appropriate assessment worksheets.
- Strictly adhere to the prescribed scoring procedures.
- Remember that if either candidate incorrectly performs any of the required actions, he or she automatically fails the entire assessment.
- Determine and document the outcome of the assessment, then transfer the final results to the *Assessment Control Sheet*.

Debriefing the Candidate

- Debrief each candidate as soon as possible after the assessment.
- Provide each candidate with a copy of the *Assessment Control Sheet*.
- Restate the assessment objectives.
- Focus on positive accomplishments first.
- Identify areas needing improvement.
- If the candidate failed to demonstrate proficiency, jointly develop an improvement plan to prepare for reassessment.

CANDIDATE INSTRUCTIONS

In this assessment, you will be evaluated on your ability to safely prepare the main engine for operation. Table 1 shows the 1995 *STCW Code* specification for preparation of main and auxiliary machinery.

Table 1. *STCW Code* specification for preparation of main and auxiliary machinery.

STCW Requirement	1995 <i>STCW Code</i> , Section A-III/1 (p. 75): Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.
STCW Function	Marine engineering at the operational level.
STCW Competence	Operate main and auxiliary machinery and associated control systems.
STCW Proficiency	Preparation of main machinery and preparation of auxiliary machinery for operation.

Assessment Objectives and Methods

A qualified assessor will assess your ability to meet the five assessment objectives in the first column of Table 2. Note that each assessment objective has a corresponding assessment type. Performance assessed by “practical skill demonstration” means your assessor will ask you to demonstrate your ability to perform the actions required in the objective. Your skill demonstration will occur onboard ship. Performance assessed by “oral or written test questions” means your assessor will ask you to respond to one or more questions and then assess your ability to respond correctly to each question.

Table 2. Assessment objectives and methods for main engine preparation.

Assessment Objective	Assessment Method
1. Perform pre-start checks.	Practical skill demonstration aboard ship / Oral or written test questions
2. Roll over the main engine.	Practical skill demonstration aboard ship / Oral or written test questions
3. Start the main engine locally.	Practical skill demonstration aboard ship / Oral or written test questions
4. Transfer main engine controls.	Practical skill demonstration aboard ship
5. Prepare plant to answer bells.	Practical skill demonstration aboard ship / Oral or written test questions

Refer to section 4 of the *Assessment Control Sheet* for a list of the specific actions required for each objective (you should receive a copy of this document from the assessor during your pre-

assessment briefing). Below are some general guidelines for what you should expect during the assessment process.

Pre-Assessment Briefing with Assessor

This briefing should occur approximately a week in advance of the scheduled assessment, if possible. This will help you and the assessor to be well prepared for the assessment when it actually occurs. During this briefing, you should:

- Discuss your prior experience, training, and/or company policy with the assessor. On the basis of these qualifications, discuss whether you are qualified to undertake this assessment. If you both agree you are qualified, then continue with the assessment process. If not, arrange for additional on-the-job or simulator training, and set a date for another review of your qualifications.
- Obtain a copy of the *Assessment Control Sheet* from your assessor. Review this document and discuss the scope and depth of knowledge covered by this assessment. Ask questions about any part of the assessment that is unclear.
- Review the assessment performance measures and standards, and ask any questions you have about them.
- Discuss the desired outcome(s) and the consequences of failing to perform any part of the assessment.
- Discuss the general assessment procedures. Your assessor will inform you of how much time is allowed, when the assessment begins, and under what circumstances he or she will terminate the assessment.
- Discuss any non-standard procedures that are expected of you during the assessment.
- Consider whether you are willing to be assessed under the circumstances presented and advise the assessor of your willingness to undertake the assessment.

Participation in the Assessment

Your assessment will begin at the local engineering control station. During the assessment, you will be working throughout the engine room, including a remote engine control station and/or the bridge control station.

The assessor will suspend the assessment if abnormal conditions develop with any equipment or if the safety of personnel or equipment is endangered. He or she will also suspend the assessment if you fail to correctly perform one of the “required” actions for this assessment (these actions are italicized on the *Assessment Worksheets* in the “standard” column).

You may have assistants to help with activities that take time such as opening the blow down valves. You are responsible for directing your assistants’ activities and verifying that their tasks have been carried out correctly.

Your assessor will continuously observe you during the assessment. You are expected to adhere to standard procedures or company policy unless the assessor briefs you on a requirement to

perform a non-standard procedure. During the assessment, remember to:

- Use appropriate marine terminology and nomenclature at all times.
- Listen to an entire question before responding or acting. Remember that you may not use reference material of any kind during the assessment examination.
- Ask questions if you have a safety concern. The assessor will provide you with appropriate responses to your questions. If a safety violation occurs, the assessor will terminate the assessment immediately.

Your assessor will ensure realistic assessment conditions consistent with the normal working environment for an engineer.

The Outcome of Your Assessment

The assessor will record your performance on a series of *Assessment Worksheets*. He or she will score each assessment objective on a “Pass/Fail” basis. Acceptable performance (a “Pass” score) will be based on your ability to correctly respond to examination questions. It will also be based on your ability to perform assigned tasks safely in a manner that demonstrates:

- The required level of skill, knowledge, and ability.
- Sound and professional judgment.

Unacceptable performance (a “Fail” score) will be based on your failure to perform a critical phase of the assessment exercise proficiently. When this occurs, your assessment will be suspended and postponed until you receive further instruction and training.

Note that the following events will terminate an assessment immediately:

- An action, or lack of action, by you which required corrective action or intervention by the assessor to prevent injury, damage, or the development of a hazardous condition.
- Failing to use proper procedures, including appropriate communication procedures, during the assessment.
- Failing to take prompt corrective action when required.

The assessor will strictly adhere to pre-determined scoring procedures, and will document the outcome of the assessment. He or she will transfer the final results of your assessment to the *Assessment Control Sheet*.

Assessment Debriefing

You and the assessor should discuss the assessment results as soon as possible after the assessment. During the debriefing:

- The assessor should provide you with a copy of the *Assessment Control Sheet* describing the results of your main engine preparation assessment.
- The assessor should restate the assessment objective(s) and identify those that you successfully demonstrated.
- If appropriate, you and the assessor should discuss the areas in which you need improvement, and then develop an improvement plan based on the assessment outcome.

ASSESSMENT CONTROL SHEET

Section 1. Assessment Reference Information

1. Name of Candidate	2. Name of Designated Assessor	3. Signature of Qualified Instructor ¹
4. Date of Assessment	5. Assessment Location ²	

Section 2. STCW Reference Information

Assessment Area	<i>Preparing the main diesel engine for operation.</i>
Assessment Method	Shipboard assessment.
STCW Requirement	<i>STCW Code, Section A-III/1, p. 75 – Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.</i>
STCW Function	Marine engineering at the operational level.
STCW Competence	Operate main and auxiliary machinery and associated control systems.
STCW Proficiency	Preparation of main machinery for operation.

Section 3. Assessment Objectives, Methods, and Scores

Assessment Objective	Assessment Method	Score	
1. Perform pre-start checks.	Practical skill demonstration aboard ship / Oral test questions	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
2. Roll over the main engine.	Practical skill demonstration aboard ship / Oral test questions	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
3. Start the main engine locally.	Practical skill demonstration aboard ship / Oral test questions	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
4. Transfer main engine controls.	Practical skill demonstration aboard ship	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
5. Prepare plant to answer bells.	Practical skill demonstration aboard ship / Oral test questions	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
COMMENTS	FINAL SCORE	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail

¹ The qualified instructor certifies that the candidate has met the training prerequisites.

² Write the name of the simulator or vessel and her location during the assessment (e.g., Massachusetts Maritime Academy training simulator, *S/R Long Beach* – Day 1 of Puget Sound to Valdez run, etc.).

Section 4. Assessment Worksheet Summary

Assessment Worksheet	Assessment Objective	Action
I	1. Perform pre-start checks.	1.1 Check power to jacket water pump. 1.2 Check power to lube oil pump. 1.3 Check power to fuel booster pump. 1.4 Check shaft turning gear. 1.5 Check engine barring gear. 1.6 Check for local control of engine. 1.7 Ensure air cocks are open. 1.8 Knowledge of proper lube oil temperature. 1.9 Check lubricating oil sump temperature. 1.10 Knowledge of proper air pressure. 1.11 Check starting air pressure. 1.12 Check fuel oil day tank level. 1.13 Knowledge of proper fuel oil level. 1.14 Check level of jacket water head tank. 1.15 Knowledge of how to fill jacket water head tank. 1.16 Check emergency stop switch position. 1.17 Check position of the air supply to clutch.
II	2. Roll over the main engine.	2.1 Start / check jacket water pump pressure. 2.2 Knowledge of proper jacket water pump pressure. 2.3 Start / check lubricating oil pressure. 2.4 Knowledge of proper lubricating oil pressure. 2.5 Initiate roll over. 2.6 Check condition of cylinders during engine rollover.
III	3. Start the main engines locally in an idling condition in both the ahead and astern directions.	3.1 Check fuel oil supply / return solenoids. 3.2 Start / check fuel oil booster pump pressure. 3.3 Knowledge of proper fuel oil booster pump pressure. 3.4 Check fuel oil booster pump strainer differential pressure. 3.5 Knowledge of proper fuel oil booster pump strainer differential pressure. 3.6 Check emergency stop valve. Place in the run position. 3.7 Start engine in ahead direction. 3.8 Check lubricating pressure upon starting engine. 3.9 Inspect engine while running. 3.10 Stop engine. 3.11 Start engine in astern direction. 3.12 Stop engine.
IV	4. Transfer control of the main engine to a remote operating station.	4.1 Switch control of engine from local console to engineer's operating station. 4.2 Start engine in ahead direction. 4.3 Start engine in astern direction.
V	5. Prepare plant to answer bells.	5.1 Open clutch control valve. 5.2 Ensure proper set up of automatic controls. 5.3 Advise bridge that the propulsion plant is ready.

ASSESSMENT WORKSHEET I

Section 1. Assessment Conditions

Assessment Objective	1. Perform pre-start checks.
Assessment Method	Shipboard assessment and oral test questions.
Candidate Orientation	There should be two candidates for assessment, each in charge of starting one engine. The assessor briefs the candidates on assessment methods, conditions, and standards. Each candidate may have assistants to help with some tasks, such as opening and closing blow down valves. Each candidate must demonstrate that he or she is in charge of the assistants and knows the tasks and when they are completed. The assessor should tell the candidates when to begin the tasks and he or she should check that each task is properly completed.
Required Equipment, Apparatus, and/or Tools	The candidates should begin the assessment at the engineer's local operating console. Main engine and supporting equipment should be secured but operational and available for use. Reduction gear and shaft system should be lined up and operational.
Initial Conditions	<p>The assessor should have received clearance from both the bridge and engineering watch officer to begin the assessment. The area should be clear so the assessor can observe activities. This assessment is an evaluation of the candidate's ability to start the main engine under normal conditions. Abnormal conditions will not be introduced. If abnormal conditions arise, the assessment will be suspended until the condition is corrected. The assessor should vary the following conditions within a normal range:</p> <ul style="list-style-type: none"> • Jacket water head tank level. • Clutch air control-valve position. • Cylinder air cock positions. • Starting air supply to the engine. • Emergency stop switch position.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1.1 Check power to jacket water pump.	Report of availability of power	Correct report of power to jacket water pump	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.2 Check power to lube oil pump.	Report of availability of power	Correct report of power to lube oil pump	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.3 Check power to fuel booster pump.	Report of availability of power	Correct report of power to fuel booster pump	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.4 Check shaft turning gear.	Ensure turning gear is disengaged	Turning gear correctly disengaged and status correctly reported <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.5 Check engine barring gear.	Ensure barring gear is disengaged	Barring gear correctly disengaged and status correctly reported <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

1.6 Check for local control of engine.	Ensure engines are in local control	Engines placed in local control and status correctly reported	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.7 Ensure air cocks are open.	Report that air cocks are open	Correct report of air cock position	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.8 Knowledge of proper lube oil temperature.	Response to question: <i>What should the engine oil temperature be before initiating engine start up?</i>	Correct response is that a normal starting range for the engine oil temperature is 120° F to 150° F	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.9 Check lubricating oil sump temperature.	Response to question: <i>What is the current lubricating oil sump temperature?</i>	Correct report of actual temperature	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.10 Knowledge of proper starting air pressure.	Response to question: <i>What should the starting air pressure be before initiating engine start up?</i>	Correct response is that starting air pressure should be at least 250 psi	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.11 Check starting air pressure.	Response to question: <i>What is the current pressure?</i>	Correct report of actual pressure	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.12 Check fuel oil day tank level.	Response to question: <i>What is the current level of fuel in the day tank?</i>	Correct report of fuel in the day tank	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.13 Knowledge of proper fuel oil level.	Response to question: <i>What is the minimum level of fuel allowable in the day tank?</i>	Correct response is that the day tank should be at least ½ full	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.14 Check level of jacket water head tank.	Response to question: <i>What is the current level of jacket water in the head tank?</i>	Correct report of level in the jacket water head tank	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.15 Knowledge of how to fill jacket water head tank.	Response to question: <i>How do you fill it if it is too low?</i>	Knowledge of how to fill the tank	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.16 Check emergency stop switch position.	Response to question: <i>In what position is the emergency stop switch?</i>	Correct report of position of emergency stop switch. <i>Incorrect report results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.17 Check position of the air supply to clutch.	Response to question: <i>What is the status of the air supply to clutch?</i>	Correct report on status of the air to the clutch	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
Total the number of "Pass" scores you indicated above.			
Pass: Score of 12-17 Fail: Score of 0-11			
Transfer the final score at right to the <i>Assessment Control Sheet</i> .			

ASSESSMENT WORKSHEET II

Section 1. Assessment Conditions

Assessment Objectives	2. Roll over the main engine.
Assessment Method	Shipboard assessment and oral test questions.
Candidate Orientation	There should be two candidates for assessment, each in charge of starting one engine. Assessor briefs the candidates on assessment methods, conditions, and standards. Each candidate must demonstrate his or her ability to "roll-over" the main engine for a pre-start inspection for leaky cylinder liners.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local operating console. The main engine and supporting equipment should be secured but operational and available for use.
Initial Condition	<p>Please note the comments regarding abnormal conditions on <i>Assessment Worksheet I</i>. Before this assessment begins, the assessor should be able to vary:</p> <ul style="list-style-type: none">• Power to the jacket water pump.• Power to the lubricating oil pump.• Presence of leak(s) in the jacket water system.• Relief valve setting on the lubricating oil pump.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
2.1 Start / check jacket water temperature.	Answer question: <i>What is the current jacket water temperature?</i>	Correct report of current jacket water temperature	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.2 Knowledge of proper jacket water temperature.	Answer question: <i>What is the proper jacket water temperature?</i>	Correct response is that jacket water temperature should be a minimum of 130° F. An acceptable range for starting is 140-160° F.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.3 Start / check lubricating oil pressure.	Answer question: <i>What is the current lubricating oil pressure?</i>	Correct report of current lubricating oil pressure	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.4 Knowledge of proper lubricating oil pressure.	Answer question: <i>What is the proper lube oil pressure?</i>	Correct response is the lube oil pressure should be a minimum of 25 psi	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.5 Initiate rollover.	Report on successful rollover	Correct procedure used	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores

<p>2.6 Check condition of cylinders during engine rollover.</p>	<p>Report on condition of cylinders as engine is "rolled over."</p> <p>Answer questions:</p> <p><i>What is the significance of water coming out of the blow down valves?</i></p> <p><i>What is the significance of lube oil coming out of the blow down valves?</i></p>	<p>Correct report of condition of cylinders during engine rollover</p> <p>Correct responses to question:</p> <ul style="list-style-type: none"> <input type="checkbox"/> A water leak means there is a jacket water leak into the cylinder. This is a problem because water is not compressible, so when the engine is started, the water will damage the valves and piston. Also, a major water leak will result in improper engine cooling. <input type="checkbox"/> The significance of lube oil coming out of the blow down valves depends on the amount of oil. A small amount is normal. If oil continues to come out as you roll the engine over, there is an oil seal failure in the turbo charger or air blower. This is dangerous as it can cause the engine to overspeed. 	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE Total the number of "Pass" scores you indicated above. Pass: Score of 5-6 Fail: Score of 0-4 Transfer the final score at right to the <i>Assessment Control Sheet</i> .	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

ASSESSMENT WORKSHEET III

Section 1. Assessment Conditions

Assessment Objective	3. Start the main engines locally in an idling condition in both the ahead and astern directions.
Assessment Method	Shipboard assessment and oral test questions.
Candidate Orientation	There should be two candidates, one in charge of starting each engine. The assessor briefs the candidates on assessment methods, conditions, and standards.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local control station.
Initial Condition	<p>The main engine should have been successfully "rolled over." All operating requirements at this point are satisfactory, including levels, temperatures, and pressures associated with support systems including jacket water, lubricating oil, and air systems. If abnormal conditions arise, the assessment should be suspended. The assessor should be able to vary:</p> <ul style="list-style-type: none"> • Fuel oil pressures drop across the suction strainer. • Fuel oil supply/return solenoid valve positions.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
3.1 Check fuel oil supply / return solenoids.	<p>Answer question: <i>What is the status of solenoid valves?</i></p>	<p>Correct report of status of solenoid valves. <i>Incorrect report of fuel oil solenoid positions results in automatic failure of assessment.</i></p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.2 Start / check fuel oil booster pump pressure.	<p>Answer question: <i>What is the current fuel oil pressure?</i></p>	Correct report of current pressure	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.3 Knowledge of proper fuel oil pump pressure.	<p>Answer question: <i>What is the minimum fuel oil pump pressure?</i></p>	Correct response is that the minimum fuel oil pump pressure is 30 psi	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.4 Check fuel oil booster pump strainer differential pressure.	<p>Answer question: <i>What is the current fuel oil pump strainer differential pressure?</i></p>	Correct report of current differential pressure	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.5 Knowledge of proper fuel oil booster pump strainer differential pressure.	<p>Answer question: <i>What is the significance of too high a differential pressure?</i></p>	Correct response is that too high a differential pressure would mean that the system is not set up properly; a valve is probably shut.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.6 heck emergency stop valve. Place in the run position.	Puts stop valve in run position	<p>Correctly places stop valve in run position. <i>Incorrect action results in automatic failure of assessment.</i></p>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

3.7 Start engine in ahead direction.	Report that engine has started, speed and direction	Correct action ahead and correct report of speed and direction <i>Incorrect action or report results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.8 Check lubricating pressure upon starting engine.	Report lubrication oil pressure	Correctly reports lubrication oil pressure <i>Incorrect report results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.9 Inspect engine while running.	Proper action to inspect engine	Correctly inspects engine while running	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.10 Stop engine.	Proper action to stop engine	Correctly stops engine <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.11 Start engine in astern direction.	Report that engine has started, speed and direction	Correctly action astern and correct report of speed and direction <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.12 Stop engine.	Proper action to stop engine	Correctly stops engine <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
Total the number of "Pass" scores you indicated above. Note that failure of 3.1, 3.6, 3.7, 3.8, 3.10, 3.11, or 3.12 results in automatic failure of this assessment.			
Pass: Score of 9-12 Fail: Score of 0-8			
Transfer the final score at right to the <i>Assessment Control Sheet</i> .			

ASSESSMENT WORKSHEET IV

Section 1. Assessment Conditions

Assessment Objective	4. Transfer control of the main engine to a remote operating station.
Assessment Method	Shipboard assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards. The assessor should tell the candidate when to stop the engine and restart in an astern direction.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local control station. During the accomplishment of this task, the candidate and assessor should move to the remote control station.
Initial Condition	The main engine should be in a local mode of operation before beginning this assessment. The assessor may choose to place engine control at either the remote engineering operating station or the bridge station (if applicable).

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
4.1 Switch control of engine from local console to either remote engineering operating station or bridge.	Verifies engine control transfer	Correctly transfers control to remote station <i>Incorrect action results in automatic failure of the assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.2 Start engine in ahead direction.	Reports engine direction and speed	Correctly starts engine and makes correct report <i>Incorrect action results in automatic failure of the assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
4.3 Start engine in astern direction.	Reports engine direction and speed	Correctly starts engine and makes correct report <i>Incorrect action results in automatic failure of the assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE Total the number of "Pass" scores you indicated above. Pass: Score of 3 Fail: Score of 0-2 Transfer the final score at right to the <i>Assessment Control Sheet</i> .			FINAL SCORE <input type="checkbox"/> Pass <input type="checkbox"/> Fail

ASSESSMENT WORKSHEET V

Section 1. Assessment Conditions

Assessment Objective	5. Prepare main propulsion plant to answer orders from the bridge.
Assessment Method	Shipboard assessment.
Candidate Orientation	Assessor briefs the candidate on assessment methods, conditions, and standards
Required Equipment, Apparatus, and/or Tools	The candidate and assessor should begin this assessment at the remote operating station (either engine room or bridge).
Initial Condition	The engine should be in a remote mode of operation before beginning this assessment. To test the candidate's knowledge of the control system, the assessor may choose to change settings on the automatic control.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
5.1 Open clutch control valve.	Verifies clutch control valve is open	Correctly opens clutch control valve <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.2 Ensure proper set up of automatic controls.	Verifies proper set up of automatic controls	Correctly sets up automatic controls <i>Incorrect action results in automatic failure of assessment.</i>	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
5.3 Advise bridge that the propulsion plant is ready.	Makes proper report to bridge	Correctly makes report to bridge	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE Total the number of "Pass" scores you indicated above. Pass: Score of 3 Fail: Score of 0-2 Transfer the final score at right to the <i>Assessment Control Sheet</i> .		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

REFERENCES

International Maritime Organization. (1996). Seafarers' training, certification, and watchkeeping (STCW Code). London: Author.

McCallum, M. C., Forsythe, A. M., Smith, M. W., Nunnenkamp, J., & Sandberg, G. (2000). Developing performance-based assessments of mariner proficiency (Report No. RDC 303). Groton, CT: U.S. Coast Guard Research & Development Center. In revision.

Stintson (1985). Diesel engineering handbook. South Norwalk, CT: Business Journals.

**Appendix D to
“A Method for Developing Mariner Assessments”**

**MARINER ASSESSMENT PROCEDURES FOR LOCATING
COMMON FAULTS AND PREVENTING DAMAGE TO
GENERATORS**

This appendix contains example procedures for assessing a mariner's ability to locate common faults and prevent damage to generators. The assessment package consists of the following: assessor instructions, candidate instructions, three assessment worksheets, and an assessment control sheet for documenting the final results of the assessment.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at <http://www.rdc.uscg.mil>.

TABLE OF CONTENTS

Assessor Instructions	1
Candidate Instructions	5
Assessment Control Sheet	8
Assessment Worksheet I.....	10
Assessment Worksheet II.....	12
Assessment Worksheet III	14
References.....	15

ASSESSOR INSTRUCTIONS

Introduction

The following procedures are designed to evaluate a candidate's ability to determine common faults during the operation of a ship service generator, including faults that occur during the start and the operations. The candidate must identify the fault and take corrective action to maintain operations or reduce the risk of damage to the generator and the electrical system.

This assessment was specifically developed for an electrical generation system that includes at least two diesel generators. The specific system used in the generation is part of a Norcontrol simulator of a slow-speed diesel plant. However, this assessment may be applicable to any electrical generation plant that has more than one diesel generator. The method of dealing with faults is specifically designed for a simulator and may not be directly applicable to shipboard installations.

The assessment materials include *Assessor Instructions*, *Candidate Instructions*, an *Assessment Control Sheet*, and three separate assessment modules (*Assessment Worksheets I-III*). The *Assessor Instructions* describe the assessment objectives, method, performance measures, and performance standards. The *Assessor Instructions* also list the responsibilities of the assessor during each phase of the assessment process. The *Candidate Instructions* explain the assessment process from the candidate's perspective and define the responsibilities of the candidate.

The *Assessment Control Sheet* provides a record of the names of the candidate, assessor, and qualified instructor who certified that the candidate met the training prerequisites for assessment. The control sheet also includes the date and location of the assessment and the STCW reference information for the competency area being assessed. Section 3 of the *Assessment Control Sheet* provides space for the assessor to record the candidate's score on each assessment objective. Finally, section 4 of the control sheet summarizes the assessment objectives and the actions comprising each objective.

As the assessor, you will evaluate the candidate's ability to complete the assessment objectives correctly. Using the scoring procedures described below, you will provide the candidate with a separate score for each assessment objective and compile these scores into a final score for the entire assessment. The scores for each assessment objective and the candidate's overall score for the entire assessment are to be recorded on the *Assessment Control Sheet*.

The rest of this section briefly describes the various components of this assessment. *Assessment Worksheets I* through *V* provide additional information about the assessment objectives, method, conditions, performance measures, performance standards, and scoring procedures.

Assessment Objectives

The candidate should evaluate the performance of the generator and its prime mover, identify faults and take action to correct the fault or minimize the potential damage. You should assess the candidate's ability to:

1. Identify and correct faults that occur during engine start.

2. Identify and correct operational faults.
3. Restore power after generator failure.

Assessment Method

These objectives should be assessed in an engine room simulator so that conditions can be varied without affecting the safety of a vessel, its crew, or equipment. The simulator can be either diesel or steam.

Assessment Conditions

The assessment should begin at the local control station. The candidate then should work throughout the engine room simulator. As the assessor, you should set the appropriate faults into the simulator controls and observe the candidate's actions. The candidate should not receive any assistance from others during the assessment.

Performance Measures and Standards

Identifying and correcting faults for the electrical generators involves approximately 17 actions. These actions include a number of steps that must be completed in sequence for a successful correction of the problem. The performance assessment will be based on demonstrating how to analyze the problem and complete each step, not on the memorizing the exact order of all the actions.

Use pass/fail scoring:

- Pass** – Performance demonstrates an ability to successfully identify the fault and carry out actions to correct the fault or prevent damage to the equipment.
- Fail** – The candidate either did not identify the fault, or when identified, did not take proper corrective action.

Note that the faults in assessment objective 1 are generally not as critical as faults in objective 2, because the potential for damage is not as great. In objective 3, if the candidate doesn't perform an action properly, he or she will not restore the power. Therefore, most of the items in objective 3 are required items – that is, if the candidate fails these items, he or she fails the entire assessment.

Individual measures and standards for each assessment objective are specified on *Assessment Worksheets I* through *III*. The range of scores acceptable for a "Pass" grade is indicated at the bottom of each worksheet.

Assessment Checklist

The following checklist summarizes the tasks and responsibilities of the assessor at each phase of the assessment process.

Preparing for the Assessment

- Start the simulator and set it in the configuration required for the assessment.
- Set desired faults in the simulator. These faults are in the objective column of the attached scoring form. One fault should be entered for each of the objectives. If there is more than one possible cause of the fault, the assessor may set any one of the possible faults. (The flexibility of the simulator may determine which faults can be set.) There are no faults to be set for the third task, restoring power after generator failure. The assessor must set up the simulator for generator failure.

Briefing the Candidate before the Assessment

- Provide the candidate with a copy of the *Candidate Instructions and Assessment Control Sheet*.
- Review the assessment procedures with the candidate and answer any questions.
- Explain the assessment performance measures and standards.
- Discuss the desired outcome(s) and consequences of failing to perform part of all of the assessment.
- Explain that the assessment will be terminated if the candidate does not correctly perform all of the “required” actions (i.e., those with an italicized note in the “standards” column of each Assessment Worksheet).
- Remind the candidate that it is permissible to ask questions during the assessment, especially if he or she has a safety concern.
- Discuss the candidate’s willingness to be assessed under the circumstances presented.

Observing the Candidate’s Performance

- If a safety violation occurs, terminate the assessment immediately.
- Continuously observe the candidate during the assessment. Require that standard procedures or company policy be adhered to except when assessment procedures require demonstration of knowledge or skill different from a convention adopted by the company or facility.
- Ensure realistic assessment conditions consistent with a normal working environment for a marine engineer. Ensure the candidate can concentrate on the task at hand.
- Avoid giving the candidate unsolicited assistance, but respond to appropriate questions and provide appropriate equipment when required.
- Remain objective and maintain positive control of the operation at all times.

Determining Assessment Outcome

- Record performance on the appropriate assessment worksheets.
- Apply the scoring procedure.

- Remember that if the candidate has incorrectly performed any of the “required” actions, he or she automatically fails the entire assessment (required actions are noted in italics in the “standard” column of each assessment worksheet).
- Determine and document the outcome of the assessment, then transfer the final results to the *Assessment Control Sheet*.

Debriefing the Candidate

- Debrief the candidate as soon as possible after the assessment.
- Provide the candidate with a copy of the *Assessment Control Sheet*.
- Restate the assessment objectives.
- Focus on positive accomplishments first.
- Identify areas needing improvement.
- If the candidate failed to demonstrate proficiency, jointly develop an improvement plan to prepare for reassessment.

CANDIDATE INSTRUCTIONS

In this assessment, you will be evaluated on your ability to successfully locate common faults and prevent damage to generators. Table 1 shows the 1995 *STCW Code* specification for operating generators and control systems.

Table 1. *STCW Code* specification for operating generators and control systems.

STCW Requirement	1995 <i>STCW Code</i> , Section A-III/1 (p. 76): Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.
STCW Function	Electrical, electronic and control engineering at the operational level.
STCW Competence	Operate alternators, generators and control systems.
STCW Proficiency	<i>Generating plant</i> - Location of common faults and action to prevent damage.

Assessment Objectives and Methods

A qualified assessor will assess you on your ability to meet the three assessment objectives in the first column of Table 2. Note that each assessment objective has a corresponding set of assessment methods. Performance assessed by “practical skill demonstration” means your assessor will ask you to demonstrate your ability to perform the actions required in the objective. Your practical skill demonstration will occur in an engine room simulator. Performance assessed by “oral test questions” means your assessor will ask you to respond to one or more questions and then assess your ability to respond correctly to each question.

Table 2. Assessment objectives and methods for locating common faults and preventing damage to generators.

Assessment Objective	Assessment Method
1. Identify and correct faults that occur during engine start.	Practical skill demonstration in an engine room simulator / Oral test questions
2. Identify and correct operational faults.	Practical skill demonstration in an engine room simulator / Oral test questions
3. Restore power after generator failure.	Practical skill demonstration in an engine room simulator / Oral test questions

Refer to the *Assessment Control Sheet* for a list of the specific actions required for each objective (you should receive a copy of this document from the assessor during your pre-assessment briefing). Below are some general guidelines for what you should expect during the assessment process.

Pre-Assessment Briefing with Assessor

This briefing should occur approximately a week in advance of the scheduled assessment, if possible. This will help you and the assessor to be well prepared for the assessment when it actually occurs. During this briefing, you should:

- Discuss your prior experience, training, and/or company policy with the assessor. On the basis of these qualifications, discuss whether you are qualified to undertake this assessment. If you both agree you are qualified, then continue with the assessment process. If not, arrange for additional on-the-job or simulator training, and set a date for another review of your qualifications.
- Obtain a copy of the *Assessment Control Sheet* from your assessor. Review this document and discuss the scope and depth of knowledge covered by this assessment. Ask questions about any part of the assessment that is unclear.
- Review the assessment performance measures and standards, and ask any questions you have about them.
- Discuss the desired outcome(s) and the consequences of failing to perform any part of the assessment.
- Discuss the general assessment procedures. Your assessor will inform you of how much time is allowed, when the assessment begins, and under what circumstances he or she will terminate the assessment.
- Discuss any non-standard procedures that are expected of you during the assessment.
- Consider whether you are willing to be assessed under the circumstances presented and advise the assessor of your willingness to undertake the assessment.

Participation in the Assessment

Your assessment will begin at the local engineering control station. During the assessment you will be working throughout the simulator.

The assessor will suspend the assessment if abnormal conditions develop with any equipment or if the safety of personnel or equipment is endangered. He or she will also suspend the assessment if you fail to correctly perform one of the required actions for this assessment.

Your assessor will continuously observe you during the assessment. You are expected to adhere to standard procedures or company policy unless the assessor briefs you on a requirement to perform a non-standard procedure. During the assessment, remember to:

- Use appropriate marine terminology and nomenclature at all times.
- Listen to an entire question before responding or acting. Remember that you may not use reference material of any kind during the assessment.
- Ask questions if you have a safety concern. The assessor will provide you with appropriate responses to your questions. If a safety violation occurs, the assessor will terminate the assessment immediately.

Your assessor will ensure realistic assessment conditions consistent with the normal working environment for an engineer.

The Outcome of Your Assessment

The assessor will record your performance on a series of *Assessment Worksheets*. He or she will score each assessment objective on a “Pass/Fail” basis. Acceptable performance (a “Pass” score) will be based on your ability to correctly respond to test questions. It will also be based on your ability to perform assigned tasks safely in a manner that demonstrates:

- The required level of skill, knowledge, and ability.
- Sound and professional judgment.

Unacceptable performance (a “Fail” score) will be based on your failure to perform a critical phase of the assessment exercise proficiently. When this occurs, your assessment will be suspended and postponed until you receive further instruction and training.

Note that the following events will terminate an assessment immediately:

- An action, or lack of action, by you which required corrective action or intervention by the assessor to prevent injury, damage, or the development of a hazardous condition.
- Your failure to use proper procedures, including appropriate communication procedures, during the assessment.
- Your failure to take prompt corrective action when required.

The assessor will strictly adhere to pre-determined scoring procedures, and will document the outcome of the assessment. He or she will transfer the final results of your assessment to the *Assessment Control Sheet*.

Assessment Debriefing

You and the assessor should discuss the assessment results as soon as possible after the assessment. During the debriefing:

- The assessor should provide you with a copy of the *Assessment Control Sheet* describing the results of your assessment.
- The assessor should restate the assessment objective(s) and identify those that you successfully demonstrated.
- If appropriate, you and the assessor should discuss the areas in which you need improvement, and then develop an improvement plan based on the assessment outcome.

ASSESSMENT CONTROL SHEET

Section 1. Assessment Reference Information

1. Name of Candidate	2. Name of Designated Assessor	3. Signature of Qualified Instructor ¹
4. Date of Assessment	5. Assessment Location ²	

Section 2. STCW Reference Information

Assessment Area	<i>Locating common faults and preventing damage to generators.</i>
Assessment Method	Simulator assessment and oral test questions.
STCW Requirement	<i>STCW Code, Section A-III/1, p. 76 – Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.</i>
STCW Function	Electrical, electronic and control engineering at the operational level.
STCW Competence	Operate alternators, generators and control systems.
STCW Proficiency	<i>Generating plant - Location of common faults and action to prevent damage.</i>

Section 3. Assessment Objectives, Methods, and Scores

Assessment Objective	Assessment Method	Score
1. Identify and correct faults that occur during engine start.	Practical skill demonstration in an engine room simulator/ Oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2. Identify and correct operational faults.	Practical skill demonstration in an engine room simulator/ Oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3. Restore power after generator failure.	Practical skill demonstration in an engine room simulator/ Oral test questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
COMMENTS:	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

¹ The qualified instructor certifies that the candidate has met the training prerequisites.

² Write the name of the simulator or vessel used during the assessment (e.g., Massachusetts Maritime Academy training simulator, *ARCO California*, etc.).

Section 4. Assessment Worksheet Summary

Assessment Worksheet	Assessment Objective	Action
I	1. Identify and correct faults that occur during engine start.	1.1 Identify and correct fault of lack of pump oil pump pressure. 1.2 Identify and correct lack of starting air. 1.3 Identify and correct lack of fuel oil pressure. 1.4 Identify and correct failure to start due to overspeed trip. 1.5 Identify and correct failure of prime mover to come up to speed. 1.6 Identify and correct failure of generator to synchronize with the bus.
II	2. Identify and correct operational faults.	2.1 Identify and correct loss of lube oil pressure. 2.2 Identify and correct overheating generator. 2.3 Identify and correct overheating of prime mover. 2.4 Identify and correct overload of prime mover. 2.5 Identify and correct loss of fuel oil pressure. 2.6 Identify and correct low cycles. 2.7 Identify and correct for overspeed.
III	3. Restore power after generator failure	3.1 Ensure non-operational engine is not connected to bus. 3.2 Start idle engine and generator. 3.3 Connect generator to bus. 3.4 Secure emergency generator.

ASSESSMENT WORKSHEET I

Section 1. Assessment Conditions

Assessment Objective	1. Identify and correct faults that occur during engine start.
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	<p>The candidate should have a strong familiarization with the equipment involved and the operations of the simulator. The assessor will be either observing the candidate directly or from the simulator control station.</p> <p>The candidate should attempt to start the generator. The candidate should then identify and correct the faults the assessor has programmed. The assessor will set the faults into the simulator and tell the candidate when to start. The assessor will then check to be sure that the task is properly completed.</p>
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local operating console in the simulator.
Initial Conditions	<p>The auxiliary generator and its prime mover are secured but operational and available for use. All the support systems are lined up and operational. The area is clear and the assessor can observe activities. The assessor should create the following faults; however, he or she can change the order in which they occur:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Prime mover fails to start due to: <ul style="list-style-type: none"> • Lack of lube oil pump of pressure. • Lack of starting air pressure. • Lack of fuel oil pressure. • Failure to reset the overspeed trip. <input type="checkbox"/> Prime mover will not come up to speed. <input type="checkbox"/> Generator will not synchronize with electrical bus.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1.1 Identify and correct fault of lack of oil pump pressure.	Checks and corrects lube oil level Starts lube oil pump	Correctly checks and corrects lube oil level Correctly starts lube oil pump	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.2 Identify and correct lack of starting air.	Checks and corrects starting air valve Checks and corrects starting air compressor Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks and corrects: <input type="checkbox"/> Air valve. <input type="checkbox"/> Air compressor. Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

1.3 Identify and correct lack of fuel oil pressure.	Checks and corrects fuel oil line up Checks and corrects dirty fuel oil filters/strainers Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks and corrects: <input type="checkbox"/> Fuel oil line up. <input type="checkbox"/> Dirty fuel oil filters/strainers. Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.4 Identify and correct failure to start due to overspeed trip.	Check and reset overspeed trip Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks and resets overspeed trip Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.5 Identify and correct failure of prime mover to come up to speed	Checks and corrects low fuel oil pressure Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks and corrects low fuel oil pressure Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
1.6 Identify and correct failure of generator to synchronize with the bus	Checks and corrects low voltage Checks and corrects low cycles Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks and corrects: <input type="checkbox"/> Low voltage. <input type="checkbox"/> Low cycles. Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
Total the number of "Pass" scores you indicated above.	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
Pass: Score of 5-6 Fail: Score of 0-4			
Transfer the final score at right to the <i>Assessment Control Sheet</i> .	FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

ASSESSMENT WORKSHEET II

Section 1. Assessment Conditions

Assessment Objectives	2. Identify and correct operational faults.
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	The assessor briefs the candidate on assessment methods, conditions, and standards and then either observes the candidate directly or from the simulator control station. The candidate should demonstrate the ability to identify and correct faults that occur on an operating generator. This demonstration of knowledge will be verified by observing the candidate reacting to the faults the assessor has programmed.
Required Equipment, Apparatus, and/or Tools	The candidate should begin this assessment from the electrical control station. During the assessment, the candidate may need to return to the engineer's local operating stations in the simulator.
Initial Conditions	The prime mover and generator should be operating properly and should be connected to the electrical bus. It may be necessary for the candidate to operate a second generator to correct the faults. To create faults, the assessor should vary the following items. He or she may vary the order in which these faults occur: <ul style="list-style-type: none"> <input type="checkbox"/> Loss of lube oil pressure. <input type="checkbox"/> Overheating of the generator. <input type="checkbox"/> Overheating of the prime mover. <input type="checkbox"/> Overload of the prime mover. <input type="checkbox"/> Loss of fuel oil pressure for the prime mover. <input type="checkbox"/> Generator cycles below operating level. <input type="checkbox"/> Overspeed of prime mover.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
2.3 Identify and correct loss of lube oil pressure.	Checks engine for lube oil leaks Stops engine, if required Starts engine, if required	Correctly checks engine for lube oil leaks Correctly starts or stops engine, as required	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.2 Identify and correct overheating generator.	Checks load on generator Reduces load on generator Checks fresh water cooling Checks ventilation level	Correctly checks and reduces load on generator Correctly checks: <ul style="list-style-type: none"> <input type="checkbox"/> Fresh water cooling. <input type="checkbox"/> Ventilation level. 	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

2.3 Identify and correct overheating of prime mover.	Checks fresh water-cooling to engine Checks ventilation in engine room Answers questions: <i>What are the potential causes of the fault?</i> <i>How should the equipment respond to your actions?</i>	Correctly checks: <input type="checkbox"/> Fresh water-cooling to engine. <input type="checkbox"/> Ventilation in engine room. Correctly responds to both questions	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.4 Identify and correct overload of prime mover.	Checks electrical load Reduces load as required	Correctly checks electrical load of prime mover Correctly reduces electrical load of prime mover	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.5 Identify and correct loss of fuel oil pressure.	Checks filters/strainers Checks fuel oil pump	Correctly checks: <input type="checkbox"/> Filters/strainers. <input type="checkbox"/> Fuel oil pump.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.6 Identify and correct low cycles.	Checks for overload Checks engine speed	Correctly checks: <input type="checkbox"/> For overload. <input type="checkbox"/> Engine speed.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
2.7 Identify and correct for overspeed.	Starts idle engine and places online Checks engine for cause of overspeed	Correctly starts engine and places it online Correctly checks engine for cause of overspeed	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

SCORING PROCEDURE

Total the number of "Pass" scores you indicated above.

Pass: Score of 6-7 **Fail:** Score of 0-5

Transfer the final score at right to the *Assessment Control Sheet*.

FINAL SCORE

Pass
 Fail

ASSESSMENT WORKSHEET III

Section 1. Assessment Conditions

Assessment Objective	3. <i>Restore power after generator fails.</i>
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	The assessor briefs the candidate on assessment methods, conditions, and standards. The candidate should demonstrate the ability to start the idle engine and generator. To successfully meet this objective, the candidate must complete the following assessment objectives, which must be completed in the proper order.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local control station.
Initial Condition	The assessor should ensure that the emergency generator is operating. One prime mover and generator should have no faults and should be ready to start. The generator supplying the electrical bus fails and the emergency generator starts. One generator and its prime mover are ready to start. There is one candidate starting the idle engine.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
3.1 Ensure non-operational engine is not connected to bus.	Checks the bus is non-operational	Correctly checks the bus	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.2 Start idle engine and generator.	Starts idle engine and generator	Correctly carries out start procedures	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.3 Connect generator to bus.	Connects generator to bus	Correctly carries out procedures for connecting generator to bus	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
3.4 Secure emergency generator.	Ensures generator is operating properly Secures emergency generator Answers question: <i>What electrical loads does the emergency generator carry?</i>	Correctly ensures generator is operating Correctly secures emergency generator Correctly answers question	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
SCORING PROCEDURE Total the number of 'Pass' scores you indicated above. Pass: Score of 3-4 Fail: Score of 0-2 Transfer the final score at right to the <i>Assessment Control Sheet</i> .		FINAL SCORE	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

REFERENCES

International Maritime Organization. (1996). Seafarers' training, certification, and watchkeeping (STCW Code). London: Author.

McCallum, M. C., Forsythe, A. M., Smith, M. W., Nunnenkamp, J., & Sandberg, G. (2000). Developing performance-based assessments of mariner proficiency. (Report No. RDC 303). Groton, CT: U.S. Coast Guard Research & Development Center. In revision.

Stintson (1985). Diesel engineering handbook. South Norwalk, CT: Business Journals.